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PICKS and SHOVELS

By O. E. POTTER

THE toughest, most clannish, most reckless and most exclusive workers in the world are a group of some 1,500 men of whom the public never hears and yet to whom it owes a great debt. They are the "sand-hogs," the men who drive the subway and vehicular tunnels beneath rivers and harbors all over the globe, and theirs is the most dangerous occupation on earth, according to Borden Chase, co-author of the original story of the motion picture "Under Pressure," which brings to the screen for the first time the action and thrills of tunnel construction.

Realism in the Movies

Journeying 6,000 miles in order to secure realism for the picture, Raoul Walsh, director for "Under Pressure," visited the Hudson Midtown bore which is being driven from Manhattan to the Jersey shore, learning by actual experience what a sand-hog's life is like, watching the actual driving processes a hundred feet below the surface of the Hudson River, going through the medical locks and visiting the locker rooms of the workers.

George B. Montgomery, general superintendent for Mason & Hanger, contractor for the job, gave the director every facility for his investigations and personally saw to it that he missed nothing which could be of use in putting the lives of modern tunnel workers on the screen. As a consequence, the picture presents a vivid portrayal of the dangers and difficulties involved in driving the various railroad and vehicular tunnels beneath our rivers, and brings to the screen for the first time authentic views of this little-known phase of construction.

A New Underworld

A full-sized replica of an actual tunnel, nearly 500 feet long, and containing all the equipment used in tunneling operations, was constructed at the

(Continued on page 16)



Fox Film Corp. Photo

Close-Up of the Bulkhead and Air Locks—Part of the Realistic Set for the Movie "Under Pressure"

Where the Money Goes

How PWA Funds Are Spent Privately for Equipment and by Labor

By KING HAMILTON GRAYSON
International Research Engineer

ONE Hundred and Five Million Dollars! This is the extent to which the people of the United States are now benefiting from the construction under-way for the Metropolitan Water District of Los Angeles, California. At its inception, scores of public officials and private citizens condemned the hoggish greed of the great western Metropolis in grasping Federal funds for a water and power supply to serve its rapidly increasing population and industries. The accusation is unfair when analyzed.

As the result of this tremendous undertaking, the industries and workmen of the entire United States will ultimately receive \$105,000,000 from the cost of the completed project. And this does not include other millions of an indirect expenditure after laborers' wages are received by the individual.

Equipment Expenditures

Let us analyze some of these expenditures to discover what localities and their industries and workmen benefit from the construction of the Los Angeles-Colorado River Aqueduct. In the line of construction equipment we first find that \$15,550,000 is being expended. This consists of

Air Compressors	\$ 1,050,000
Automobiles	500,000
Blowers	450,000
Railway Cars	600,000
Concrete Plants	750,000
Crushing and Screening Plants	1,250,000
Locomotives	3,000,000
Motor Trucks	590,000
Rock Drills and Sharpeners	1,350,000
Shovels and Mucking Machines	1,740,000
Dragline Excavators	380,000
Tractors	3,040,000
Incidental Equipment	

(Continued on page 21)

Concrete Pumped Through 750-Foot Line for Water Supply Dam



C. & E. M. Photo

Aggregate and Concrete Plants—Concrete Pump and Pipe Line in Foreground

A. E. D. Elects Officers

The Associated Equipment Distributors have elected the following officers for 1935: John C. Louis, John C. Louis Co., Inc., Baltimore, President; J. S. Gilman, Wm. H. Ziegler Co., Inc., Minneapolis, 1st Vice President; and G. F. Lowe, Lowe-Hillsman Co., Chicago, 2nd Vice President. A. C. Blaisdell, Blaisdell-Folz Equipment Co., Cincinnati, was re-elected Secretary and Treasurer.

Connecticut Contractor Crushed and Screened Aggregates at Site

(Photos on page 40)

PUMPING concrete distances as great as 750 feet featured the work of the C & R Construction Co. of Boston, Mass., on the new Bills Brook Dam at Barkhamsted, Conn., built for the Metropolitan Water Bureau of Hartford, Conn. Nearly all concrete for the core wall, conduit, upper and lower gate houses and the waste channel, amounting to more than 25,000 cubic yards, was placed by a single Pumpcrete machine.

When this project is completed there will be none of the concrete masonry exposed.

The concrete pump was set up at the base of the hill at the east of the dam site below the aggregate screening and washing plant so that concrete from the 1-yard concrete mixer could be delivered to the agitator hopper. Another chute permitted delivery to trucks for hauling to more distant points as required. Since a pump normally handles liquids, it was natural to believe that a high-slump concrete would give the best results with the machine. The contractor used a 3- to 4-inch slump concrete first but this was changed by the engineer to a 2-inch slump which gave the best results.

Maximum delivery was through the equivalent of 850 feet of straight pipe. The line included two 22½-degree elbows, each with a friction loss equal to 10 feet of straight pipe, and four 45-degree elbows, each equal to 20 feet of straight pipe, depending on the character and slump of the concrete. The single Pumpcrete unit installed delivered normally to a distance of 600 equivalent feet. Part of the delivery was down hill so that a greater distance

(Continued on page 10)

Thoughts on Highway Construction

from American Road Builders' Convention

What doth it profit a contractor to get a job and lose his wad?—F. A. Cannon, Secretary, Highway Industry Code Authority, Milwaukee, Wis.

The average work per week for highway laborers under PWA 30-hour restriction, based on a 309,000 payroll throughout the country, was 2.9 days of 8 hours each.—William P. MacDonald, Wm. P. MacDonald Construction Co., Flushing, N. Y.

The building of the high class penetration macadam highway of Massachusetts is not entirely a question of specification; it is the product of the experienced contractors, engineers and inspectors.—A. W. Dean, Chief Engineer, Massachusetts Department of Public Works.

Contractors—in a strict meaning of the word we are not contractors. Rather are we in the insurance business, insuring to the various official highway authorities that we will administer a contract as they direct, and ourselves absorb any excess cost.—E. Sutcliffe, President, National Bituminous Paving Industrial Assn.

Of 32,044 laborers employed by contractors on Illinois highway projects in 1933, without PWA and FRS employment restrictions, 89 per cent of the total were local residents living within the vicinity of the job, 10 per cent were non-local but residents of Illinois, and the remaining 1 per cent were non-residents of the State. These figures include executives, administrative, skilled and unskilled employees.—Charles B. Cochran, Dungey & Cochran Construction Co., Marion, Ill.

1934 was the first year in the history of the United States that the total number of grade crossings decreased.—Thos. H. MacDonald, Chief, U. S. Bureau of Public Roads.

The two outstanding educational exhibits at the Washington A. R. B. A. meeting were the talking movie of the auxiliary roller for insuring smoothness in bituminous roads, and the motion picture of tests of steel plate safety guard rail.—Theodore Reed Kendall, Editor.

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Are You Losing Profits Through Lost Time?

Part IV

THE details of plant set-up and arrangement of various pieces of equipment in a bituminous mixing plant play an important part in determining whether or not a job will show profits or losses at its completion. This installment of the study of the factors resulting in time losses in the construction of mixed bituminous pavements, made by the Division of Management, U. S. Bureau of Public Roads, and reported by C. F. Rogers, Assistant Highway Engineer for the Bureau, offers some pertinent suggestions for efficient plant set-up.

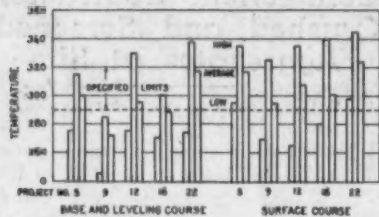


Fig. 8. Average and Extreme Temperatures of Loads Leaving Plant on Five Projects

"Too Many Dryers"

Delays at the dryer may result from the use of a dryer of inadequate capacity, or from the use of excessively moist material. Dryer capacity depends on a number of variables and calculations of capacity are based on an empirical formula. Table 5 shows the dimensions and characteristics of dryers at eleven of the plants studied.

Examination of the data shows that the capacity of a dryer is, to a considerable extent, dependent upon the degree of agitation of the material. Agitation is affected by the details of the dryer design and particularly by the baffling which controls the height of fall. Table 6 demonstrates this relationship.

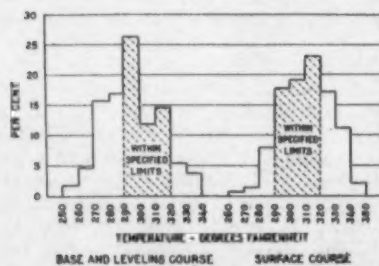


Fig. 9. Comparison of Daily Average Temperatures of Loads Leaving Plant

Efficiency of dryer operation is to be judged not only by rate of output but also by the temperature of the materials as they leave the plant. Variations in the temperature of mixed materials affect every operation in laying the surface and frequently result in lack of smoothness and density. Samples of compacted

Studies of Time Losses in the Construction of Mixed Bituminous Roads

pavement of the same mix have shown a percentage of voids ranging from 7 to more than 16. The excessive void content was attributed to low temperature during compaction. Figure 8 shows the average and extreme temperatures of batches leaving the plant on five jobs. Figure 9 shows percentage of batches of different temperatures as combined for seven projects. Temperature observations were made on both base and surface mixes at seven plants on 324 days and in only 55.8 per cent of the cases were the temperatures within the specified limits. Extreme ranges of temperature exceeded 100 degrees. Failure to meet the specification for temperature on base and leveling course was most often due to low temperature but in the case of surface course it was most often due to excessive temperature.

Hot materials are transported from the dryer to the screens by a bucket elevator. It is important that both the elevator and screens be housed and insulated to prevent a waste of heat and hence unsatisfactory results in laying

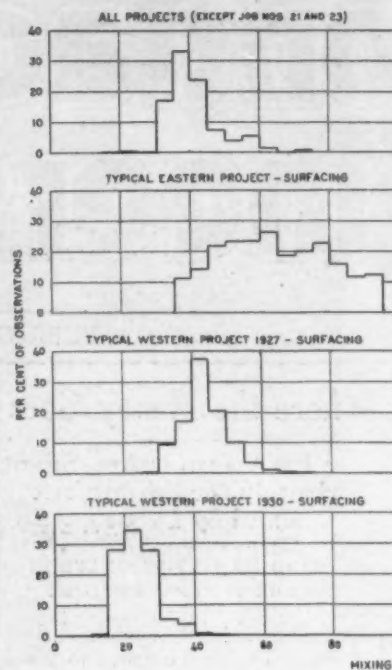


Fig. 10. Mixing Times Grouped at 5-Second Intervals and Plotted on a Percentage Basis

the surface.

Adequate Screens and Bins

In designing a plant for a given capacity it is readily possible to determine the amount of material to be handled by each size of screen. However, the output of a screen depends on a number of variables and designs are based on empiric formulas. The observations which have been made indicate that a margin of production should be provided to care for uncertainties of operation. Troubles arising from inadequate capacity can-

(Continued on page 14)

Highway Business Better During 1934

The improvement in business in the highway construction field during 1934 is shown by the consumption of asphalt and road oil for the first eight months of that year, which indicated a 25.1 per cent gain over the same period in 1933, according to the Asphalt Institute.

Shipments of brick for highways for the first ten months of 1934 were double those for the same period of the previous year, announced the National Paving Brick Association.

These improvements in highway business are credited by the American Road Builders' Association directly to the expenditures of Federal funds under the National Recovery Act of 1933 and the Hayden-Cartwright Act of 1934.

Grading with Scrapers 24 Hours a Day

(Photo on page 40)

THE most northerly sections of the Cambridge-Concord Highway in the Towns of Concord and Lincoln, Mass., were two of the four sections awarded to B. Perini & Sons, Inc., by the Massachusetts Department of Public Works, Division of Highways, last spring. The contractor had sized up the grading situation and figured that most of the excavation could be most economically handled with LeTourneau Carryall scrapers of 12-yards capacity. Two of these giant excavators, each with 13.50-20 Firestone heavy-duty tires, were placed at work, hauled by Caterpillar Seventy-Five diesel tractors.

Quantities

In order to show the magnitude of the work which these machines handled, the major excavation items are listed below:

Item	Quantity
Earth excavation.....	233,000 cubic yards
Ledge excavation.....	13,200 cubic yards
Ordinary borrow.....	184,600 cubic yards
Cravel borrow.....	77,000 cubic yards
Bridge excavation.....	4,350 cubic yards
Peat excavation.....	30,400 cubic yards

Features of Operation

The scrapers were operated with their

B. Perini & Sons, Inc. Handled 85 Per Cent of Earth Excavation With 12-Yard Machines

tractors on four 6-hour shifts with only sufficient time off on each shift for the complete lubrication of the machines with an Alemite volume-pressure gun and smaller hand gun. The tractors were equipped with Guide headlights and a single tail-light to illuminate the Carryall dumping mechanism and the cutting edge. Prest-o-lite hand floodlights were used by the operators to light up the machines while lubricating them at night.

Whether it was a light cut to be made to bring the ground surface to grade, or a heavy cut that required many trips over the section, the Carryall scrapers weaved their way back and forth behind the tractors and cut, carried and spread the material. The foreman decided that, because of certain operating conditions, it was most economical to make some of the heaviest cuts on the up grade and then turn and carry the load down grade to the dump. One of these operations is shown in the illustration, where the top of the grade was at the elevation of a new bridge under construction.

Even though the fill extended across the end of a peat swamp or muck hole, the tractors and scrapers carried on, working close to the edge and placing the excavated material near to the edge, gradually filling the muck hole so that the material, which was a real peaty loam, was forced up at the far side and dried into a black loam fit for use as a humus.

On the type of work for which these machines are especially adapted, as with the quantities listed above, in the absence

of ledge, they operate most economically in replacing a much larger number of units or gasoline-operated equipment. It is not necessary to keep roadways in such constant repair as for a fleet of trucks, and the constant tracking of the tractors helps materially to compact the fill.

The pair of 12-yard Carryall scrapers used on this section of the Cambridge-Concord Highway moved about 1,000 yards of material each in each 12-hour period of operation. For each of the 6-hour shifts there were only the two tractor operators and a foreman.

Personnel

A. Macauley was Superintendent for B. Perini & Sons, Inc., of Framingham, Mass., with A. R. Berry, Resident Engineer and K. C. Prescott and T. G. Giblin, Assistant Engineers for the State Department of Public Works on this section.



C. & E. M. Photo
Thorough Lubrication of Tractors on Every 6-Hour Shift

Table 5.—Characteristics of Typical Dryers

Job No.	Length	Diameter	Pitch	Revolutions per minute	Empirical capacity in tons per hour under various conditions		
					Poor	Average	Good
	<i>Feet</i>	<i>Inches</i>	<i>Inches per foot</i>				
1.....	24.0	66	0.88	9.7	70	90	110
2.....	20.5	60	.75	10.3	60	70	90
3.....	18.0	60	1.00	6.6	60	75	95
4.....	24.0	72	.76	5.3	70	90	110
5.....	24.0	54	1.00	9.5	65	85	100
6.....	22.0	72	.75	8.0	97	124	150
7.....	22.0	72	.85	7.0	83	108	135
8.....	23.0	60	1.00	7.7	70	90	110
9.....	20.5	60	1.25	7.0	60	70	90
10.....	22.0	72	.75	8.0	97	124	150
11.....	22.0	72	.75	8.0	97	124	150
Average.....	22.0	66	.89	7.9	75	95	117
Typical.....	24.0	72	.75	8.0	90	120	150

Table 6.—Relation between Height of Fall of Material in the Dryer and Output at Four Typical Plants

Height of fall of material	Capacity per hour	Material in dryer at any instant	Time required to produce a ton of material
Feet	Tons	Tons	Seconds
3.48	150	5.21	24.0
2.82	118	6.72	30.5
2.11	89	2.42	40.8
1.25	69	1.17	52.2

A few

TEXACO PROJECTS of 1934



NEW YORK

The widely known Meadowbrook Causeway, joining Long Island to two famous beaches—Jones Beach and Long Beach—was surfaced with cold laid asphaltic concrete, in which 500,000 gallons of TEXACO Asphalt were used.

KENTUCKY

A 14-mile section of Kentucky State Highway No. 25 near Lexington was surfaced with two 2-inch courses of stone and 340,000 gallons of TEXACO Cutback Asphalt.

OKLAHOMA

The City of Tulsa and Tulsa County improved streets and roads with 1,800,000 gallons of TEXACO Asphalt Surfacing Material during 1934.

KANSAS

31½ miles of U. S. Highway No. 166 in Chautauqua County were treated with 377,000 gallons of TEXACO Surfacing Material.

IOWA

21 miles of Cass County roads became waterproof and dustless, after application of TEXACO Surfacing Material.

TEXAS

11 miles of Route No. 1 between Dallas and Fort Worth were topped with TEXACO Asphaltic Concrete last year.

Again in 1934

America added widely to the thousands of miles of TEXACO Asphalt surfacing on its streets and roads

TEXACO
ASPHALT

Chicago
Cleveland
Kansas City
Houston
Dallas
Buffalo

THE TEXAS COMPANY
Asphalt Sales Department
135 E. 42nd St., New York City

New York
Philadelphia
Richmond
Boston
Jacksonville

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Are Engineers Afraid To Discuss Mistakes?

"It has seemed to me that it would be very desirable if such papers (referring to a paper on the history of bridge foundations presented by Carlton S. Proctor before the Metropolitan Section, American Society of Civil Engineers) could go freely and fully into the difficulties or accidents which happened in construction of the work," said Daniel E. Moran, prominent foundation engineer, and continued, "It is difficult to draw the line between when it is proper in presenting a paper to go into such matters, and when it is perhaps highly improper to do so."

In the case of the Mid-Hudson Bridge at Poughkeepsie, N.Y., where the east main pier fell over on its side during construction, requiring over a year to right the caisson and restore it to its proper position, at present it is out of order to discuss the accident as there is a suit pending against the State of New York.

If engineers and contractors at their meetings, either separate or joint, would hold "post mortems" and air their griefs and troubles rather than devoting all of their time to the presentation and discussion of papers lauding records for speed and new methods of construction developed, perhaps as the result of difficulties which are not discussed in the paper, it would be of tremendous help to both groups who must cooperate in the construction of such great projects.

Mr. Moran further brought out in his comments that engineers may design caissons to be floated to the site of the bridge pier but the contractor may decide to sink all of them by the sand method. In discussing this further he said,

"In another case that I know of the piers were designed to be sunk by the pneumatic caisson method and partly by dredging, but no dredging was done and the piers were sunk entirely by the pneumatic caisson method. It is a mistake to believe that the path of the contractor is not beset with thorns or to believe that the bed of the engineer is one of roses without at least occasional thorns found with the roses."

Mr. Moran in concluding his com-

ments said, "It is my judgment that the work of the engineer is not completed when the design is finished, but that he should continue with the work and be ready to make such changes as may be found desirable or to assist in overcoming difficulties which may occur. The successful completion of an enterprise depends on the united efforts of all concerned."

A Notable Dedication and Appreciation

On May 26, 1934, the Pine Canyon Dam of the Pasadena, Calif., water supply was dedicated just twenty-five months after construction commenced. The Honorable Herbert Hoover, using but 51 words to sum up and dedicate this project, said:

"On behalf of those far-seeing leaders of this community, the engineers whose skill has brought this plan to practical realization, and the community which has given to them their loyal support, I dedicate the Morris Dam to the service of a hundred generations of Americans who will receive the blessings."

S. B. Morris, Chief Engineer and General Manager of the Pasadena Water Department for whom the dam was named, expressed his appreciation of this honor in the closing paragraph of his annual report just released:

"I cannot let this opportunity pass without expressing my most sincere appreciation to you [the city manager] and to the Board of Directors for your continued support and guidance, and particularly for the honor you have done me in naming the Morris Dam. The action of the Chamber of Commerce in inviting the Honorable Herbert Hoover to dedicate the dam and in bringing also my dear Professor Charles D. Marx from Stanford to take part in the banquet tendered me after the dedication, has brought a wonderful climax to my happy years of conceiving, planning and constructing the San Gabriel Project for the City of Pasadena. And to the staff of the Water Department I wish to express my special appreciation and gratitude for their loyal and efficient service to the City."

Simplicity, sincerity and appreciation, three great spiritual values found only in the truly great.

Schooling for Inventors

Despite the depression, America easily leads the world in the number and quality of its inventions. From the Patent Office at Washington will soon be issued the 2,000,000th patent, whereas the patents issued in all other countries in the world put together number about 4,000,000. An investigation just concluded by the Inventors Foundation, Inc., 122 E. 42nd St., New York, reveals some interesting facts concerning the American patent field. New patents are being issued in Washington at the rate of about 1,000 a week. The inventive genius of America is being stimulated rather than discouraged by the depression. It has been found that most in-

ventors, while prolific in ideas, are too lacking in technical knowledge of invention procedure and patents and in proper business experience to make the most of their ideas.

For the first time in the long history of inventions, regular courses of instruction are now offered to inventors at New York University, Stevens Institute of Technology, and by correspondence courses. The inventor is instructed by competent teachers in the details of inventing, in the most advantageous way of disposing of patents, and in securing the adequate share of the returns. The Inventors Foundation, which sponsors the new movement, is organized on broad philanthropic lines. It was created by Henry J. Gaisman, one of America's foremost inventors.

Wire Rope Lubrication As Reader Sees It

To the Editor
Contractors and Engineers Monthly

I was very much interested in your article in the December issue on "The Lubrication of Wire Rope."

My experience, dating back for a number of years, has taught me the value of lubrication. The severe use to which wire rope is subjected makes lubrication a question of how to lubricate and get the full value of it. The idea of a thin oil that will penetrate to the center core seems to be proper, but the oil must be of a degree to suit the weather conditions, and applied in a manner that will permit it to reach the core strand.

I would suggest hanging a hollow sheave directly over the point sheave of the boom, with small holes in the groove to allow the oil to drip onto the wire rope as it passes by. The top strands of the wire rope are more open at that point than at any other. I will not go into the details of the construction of the oiling sheave in this letter but it must be well secured in hanging to withstand the whip of the broken end when the cable breaks back of the point sheave as it sometimes does. The breaking point is the center of travel over the point sheave and generally gives way on the sheave. I believe this plan would lengthen the life of the cable enough to show profit.

I have used wire rope spliced, with the splice traveling over the drum under strain, and got very good service, but any one trying a well-lubricated spliced wire rope over a drum will meet with a surprise. I tried it!

A drag cable with wire rope center can not be helped with lubrication, but care in use by not allowing it to untwist and throw one strand out to take wear, or allowing it to twist up too tight and cross strands on the drum, will result in uniform service from drag cables. A bad feature is to allow the cable to pinch if it turns up on the second turn of the drum. This can be remedied by a welder building up against the flange of the drum so the cable will lift and not pinch. The operator should always notice where the cable breaks and see if there is any special reason for the break.

I have considered lubricating drag cables by covering them with a sticky lubricant, claimed to be a saving but in use I have never had it proved to be so. The cost and life it gives does not average up any better.

CONTRACTOR.

St. Charles, Mo., December 24, 1934.

Tribute to Engineers

"Viewing the [highway] program as it has gone forward in the past two decades, I can not close this statement without some measure of appreciation for the Federal and state highway engineers of the country. While politicians have frequently taken the glory, these engineers have done the work, quietly, efficiently and with integrity. The general public knows little about them, but the highways they are building stand as a splendid testimonial to the public official at his best. They deserve the constant support of the motoring public."

—From a statement of Roy D. Chapin, Chairman of the Highways Committee of the Automobile Manufacturers Association.

Charge of Highway Subsidies Rests on Shaky Foundation

"Traditionally, community use of the highways has been a fixed privilege of the people from the days of the Roman roads, King's highway and National turnpike, so that the charge of subsidization at best rests upon a shaky foundation."—From an Editorial in the Chicago (Ill.) Tribune.



Copyright Cartoon by Fred Neher, Published by Courtesy of New York Sun

"Elevator's Out of Order, Dear"

\$125,000,000 for Roads From Federal-Aid Fund

The apportionment of \$125,000,000 for Federal Aid to the States in highway construction in the fiscal year beginning July 1, 1935, marks the resumption of the old policy of Federal highway aid. The apportionment was made by Henry A. Wallace, Secretary of Agriculture, on December 27 under the authorization contained in the Hayden-Cartwright Act of June 18, 1934.

In making the apportionment, Secretary Wallace called attention to the possibility of reduction of a State's apportionment through the operation of the provision in the Hayden-Cartwright Act relative to the diversion of gasoline taxes and other taxes on motorists. The Act provides that Federal Aid for a State's highways shall be reduced unless the State uses for highways at least the amounts provided by law on June 18, 1934, for that purpose from the State's gasoline and motor vehicle taxes and other special taxes on motor vehicle owners.

The apportionment is as follows:

State	Sum	State	Sum
Ala.	2,404,330	Nevada	1,595,581
Aris.	1,781,347	N. H.	609,375
Ark.	2,142,723	N. J.	1,675,751
Calif.	4,756,959	N. M.	1,999,299
Colo.	2,586,811	N. Y.	6,150,106
Conn.	791,253	N. C.	2,938,657
Del.	609,375	N. D.	1,960,102
Fla.	1,655,723	Ohio	4,565,485
Ga.	3,168,221	Okla.	2,947,531
Hawaii ..	609,375	Ore.	2,044,633
Idaho	1,531,162	Penn.	5,348,062
Ill.	3,160,696	R. I.	609,375
Ind.	3,087,613	So. Car.	1,692,886
Iowa	3,231,718	So. Dak.	2,036,775
Kans.	3,317,054	Tenn.	2,638,139
Ky.	2,304,143	Texas	7,777,504
La.	1,776,939	Utah	1,410,732
Maine	1,090,167	Vt.	609,375
Md.	1,625,870	Va.	2,278,475
Mass.	1,741,877	Wash.	1,949,957
Mich.	3,837,292	W. Va.	1,356,798
Minn.	3,423,596	Wis.	3,045,557
Miss.	2,196,534	Wy.	1,559,444
Mo.	3,800,856		
Mont.	2,560,449	Total	\$125,000,000
Nebr.	2,581,663		

A 12-Billion Program for Two Years' Construction

During the ten years, 1920 to 1930, there was actually spent in construction \$9,000,000,000, one-third of which represented public works, Federal, state and municipal. A \$3,000,000,000 public works program, if it continues to carry the state, county and municipal as it has in the past year, is therefore no abnormal amount to be spent. It looks large merely because it includes works for the states and local governments as well as for the Federal. Therefore a \$12,000,000,000 public works program, spread over two or more years, is not really abnormal.

When Dominicus Fontana was moving the Vatican Obelisk with 40 capstans and tackles in 1586 A.D., the stretching of a new hemp rope threatened the success of the work. In spite of the death penalty imposed to insure silence among the workers, a sailor named Bresca shouted, "Wet the rope" and thus saved the day.

Another Dirt Mover Halts Old Man River

Lewis-Chambers Co.
Built Levee with Bridge

THE Chambers Bridge is the latest development for handling dirt to prevent the great Mississippi River from flooding the low lands which extend back from its banks for leagues. It is a long step from man power and wheelbarrow days through wagons hauled by mules, tower machines, walking draglines, crawler wagons, belt conveyors and now the 372½-foot Chambers Bridge.

The New Machine

According to the engineers of the Bucyrus-Erie Co., which built the Chambers Bridge from designs of John T. Chambers, Vice President of Lewis-Chambers Construction Co., Inc., "the Chambers Bridge consists of a mobile frame, mounted on crawler trucks, supporting two bridges of substantially equal length extending from the sides of the frame. These bridges are suspended by a wire-rope tackle from an A-frame structure and may be raised or lowered to provide an angle suitable to the operating conditions. In a sense this machine is a mobile hoist similar to a mine hoist, having a car traveling on rails in a horizontal or inclined plane and taking the excavated material from a hopper at the loading end and transporting it to the point of discharge. The frame carries the machinery and power unit to move the car to dumping positions, return it to the loading position and to perform the other functions of hoisting and lowering the bridges, and propelling.

"The Chambers Bridge performs a dual function on excavating projects: first, it increases the operating range of the excavating unit and second, it increases the output of the excavator since it permits it to spend a greater portion of its operating time in actual digging, due to the fact that the transportation part of the cycle is taken over by conveyor means."

The Laconia Project

Lewis-Chambers moved into the Laconia Circle levee job during January and February, 1934. The equipment was brought to Laconia on barges from the Shipland Levee near Mayersville, Miss., where the contractor had been working, and landed as near to the job as possible. Camp for the workers was established, the necessary shops set up, and considerable time spent in tracking the various machines an unusually long distance from the river to the point where operations were to start. All of the machines were given a complete overhauling, in accordance with the practice of the best levee contractors.



The Chambers Bridge Which Has a Working Range of About 350 Feet and Can Handle the Round Trip of a 10-Yard Car Every 50 Seconds

To build the 2,500,000-yard levee the company placed on the job: two Bucyrus-Erie Class 230 steam oil-burning draglines, truck-mounted, each with a 175-foot aluminum boom and a 6-yard bucket, one starting work in February and the other in March; one Bucyrus-Erie diesel 45-B dragline, with a 65-foot boom and a 2-yard bucket; one Bucyrus-Erie diesel 52-B dragline, with a 60-foot boom and a 3-yard bucket; one Northwest dragline with a 1-yard bucket and a 40-foot boom; and four Allis-Chalmers crawler tractors each equipped with bulldozers.

ers crawler tractors each equipped with bulldozers.

Operating Features of Bridge

The Chambers Bridge is a plate-girder structure 372½ feet long, supported by a double A-frame tower in the center. The tower contains the power plant and operating controls. On tracks mounted on the girders of the bridge, a 10-yard car carries the dirt from one end of the bridge to the other, propelled by a cable attached to drums driven by

the main engine. A hopper at the loading end is filled by either one large, or two small draglines.

On the Laconia job the hopper is fed
(Continued on page 19)

New 28-Pound Drill Easy to Handle

Combining the features of powerful rotation, satisfactory blowing and easy riding, a new 28-pound sinking drill, known as the S-35, has recently been announced by the Gardner-Denver Co., Quincy, Ill.

Owing to its light weight, the new drill is easy to handle in places inaccessible to a heavier drill, and is especially suited for drilling in soft and medium formations, as well as for plugging in quarries or on construction jobs.

The S-35 has a full grip D handle, a short throw tubular valve totally enclosed, one-piece exhaust-control valve and handle, and a simple rugged steel puller. The air inlet is conveniently placed, and there are no side rod springs.

BLAW-KNOX ROAD BUILDING EQUIPMENT

MODERN EQUIPMENT—Always Kept Up to Date for Better—Faster and Cheaper Work

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Write for descriptive catalogs

McKiernan-Terry Corp.

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Distributors in Principal Cities

Slag-Asphalt Surface on Sand-Clay Base

MANY states are showing, through intensive work, that the highways which have been long neglected because of highway funds can be surfaced economically by some form of bituminous surfacing and thus extend the present inadequate funds for greater mileages. Florida has been one of the states that has produced excellent roads for many years from the natural products of the state, including lime-rock and sand-clay. The project discussed in this article included the grading of a new section of an important north and south highway in west Florida followed by a slag surfacing bound with bitumen.

Grading

The highway section included in the contract was 4.75 miles in length and clearing and grubbing started December 6, 1933. About two-thirds of the right-of-way was new location, necessitating extensive clearing. Grading was handled by a P & H dragline with 50-foot boom and $\frac{3}{4}$ -yard bucket loading to 5 trucks. About eight 2-up mule teams with Galloway wheel scrapers were used for grading where the cut was small and the haul within the 1,000-foot free haul limit. For the longer hauls which ran as high as 1,500 feet the trucks were used.

There were 92,000 cubic yards of excavation, including the stripping of the sand-clay pits, and of this quantity 27,000 yards was in one 850-foot cut which had a maximum depth of 15 feet. The fills were spread entirely by hand labor, using a crew of from three to eight men. The tops of the fills and bottoms of the cuts were brought to grade with a Caterpillar 12-foot grader pulled by a Caterpillar Sixty tractor.

This 21-foot base was then compacted by traffic with constant maintenance for about 30 days before further treatment. The haul for the natural sand-clay which was used for the base course varied with the location of the three pits used. One was about $2\frac{1}{2}$ miles from the north end of the work with dead haul for the full distance, while the other two were near the south end. For $\frac{1}{2}$ mile at the north end of the contract it was only necessary to add sand to the base to give the proper sand-clay mixture. After the base was complete it was swept by hand for the full length to remove any loose material before "shooting" with the tar prime.

Bituminous Treatment

The prepared base was treated with tar furnished by the Koppers Products Co. by tank car at Milton, Fla., about 3 miles dead haul from the south end of the work. This tar known by the specification name of TO2, had a viscosity of 15. An Etnyre 582-gallon distributor was used to haul and apply the tar at the rate of 0.3-gallon per square yard for a width of 20 feet. The tar usually penetrated from $\frac{3}{8}$ - to $\frac{1}{2}$ -inch into the dry prepared base. No tar prime was applied when the base was damp.

This application of tar was allowed to dry out for about three days and then the road was opened to traffic to anneal the surface for about three weeks, during which time blocks or barricades were placed in the roadway to spread traffic over the entire surface evenly. The roadway was opened in sections as soon as any one portion was ready after the prime, thus traffic had to be detoured around several sections of the road at any one time. This is no trial in Florida as detours are readily cut through the woods and the mat of roots with the sand furnishes a very acceptable temporary roadway.

Completing the Surface

Before the application of the asphalt

Inverted Penetration on Tar-Primed Base Typical Construction on Florida Highway

for binding the slag surfacing material, the surface of the roadway was swept thoroughly by hand to remove any loose material not fully primed by the initial treatment. Then 0.45-gallon per square yard of asphalt and flux, having a viscosity of 8 to 13 furnished by the Pan American Petroleum Corp., was applied at a temperature of 300-325 degrees Fahrenheit. This application was followed up immediately with a layer of coarse granulated slag from 1 inch down to $\frac{3}{8}$ -inch applied by spreader

boxes to a depth of about 1 inch. Hand brooming was used to distribute the material uniformly over the surface. This was followed by rolling with a 5-ton 3-wheel or 7-ton tandem roller or both to interlock or key the aggregate with the asphaltic application and the primed base.

Fine slag from 4- to 8-inch screen size was then applied by the spreader boxes to fill the voids of the coarser material, immediately followed by rolling. This method gave a surface course about $\frac{3}{4}$ -inch thick. Loose fine slag from the last application was not broomed off but permitted to remain and be whipped off by traffic.

Personnel

This 4.75-mile contract, which was awarded to C. C. Moore Construction Co., of Jacksonville, Fla., for \$56,616.10, was started December 6, 1933, and completed September 15, 1934, with C. C. Moore in immediate charge of the work. For the State Road Department of Florida, S. D. Hall was Project Engineer.

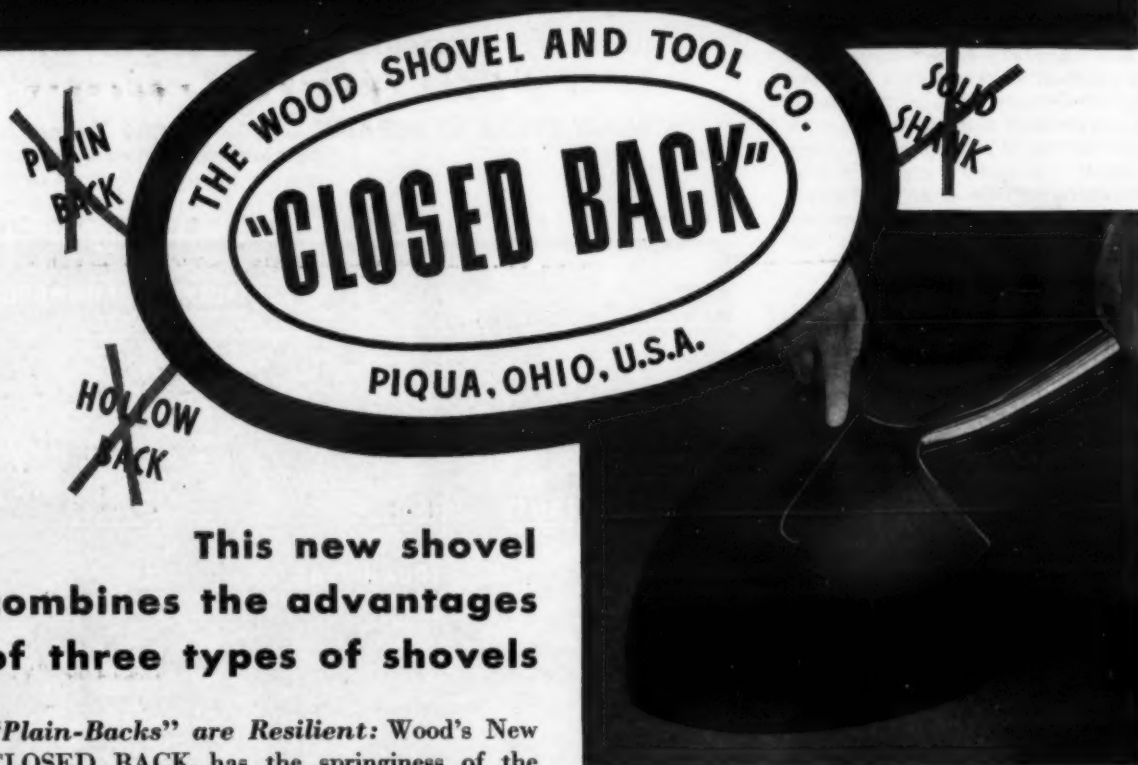
Distributor Appointments for Bucyrus-Erie

Bucyrus-Erie Co., South Milwaukee, Wis., has announced the appointment of the Arizona Tractor & Equipment Co., 138 So. First Ave., Phoenix, Ariz., as distributor for power shovels and draglines up to 2-cubic yard capacity throughout the State of Arizona.

Announcement has also been made of the appointment of Brooks-Payne-Osborne Equipment Co., P. O. Box 1407, Knoxville, as distributor for power shovels and draglines of 2-cubic yards and smaller capacity and for Loadmaster cranes in eastern Tennessee.

E. E. Wallace Co., 1807 Elmwood Ave., Buffalo, N.Y., has been appointed distributor for Loadmaster cranes for the western part of New York State; C. G. Landes, 63 So. High St., Columbus, will handle Loadmaster cranes for the central section of Ohio; and Collier Tractor & Equipment Co., 502 E. 4th St., Reno, Nev., will act as distributor for these cranes in north and west Nevada.

Are you buying
too many types of shovels?



This new shovel
combines the advantages
of three types of shovels

"Plain-Backs" are Resilient: Wood's New CLOSED BACK has the springiness of the strap shovel and will stand even greater distortion, without visible, permanent "set." No strap welds to pull loose.

"Hollow-Backs" are Light: So is Wood's New CLOSED BACK,* but the objectionable open space has been cleverly eliminated.

"Solid-Shanks" are Strong: Wood's New CLOSED BACKS are stronger without being rigid. Also they have the hang or balance of the plain back shovel.

Why have so many different types and styles of shovels on your jobs, when one will do the job and do it BETTER!

*The CLOSED BACK averages about 4 pounds in all grades and types of size 2 shovels.

Caution: This type of shovel was originated by The Wood Shovel and Tool Company and is made on special machinery developed over a period of time. Patents have been applied for on both the shovel and the process. Ordinary welding processes will not produce a shovel with the strength of the genuine WOOD'S CLOSED BACK. Write today for the booklet which fully illustrates and describes WOOD'S CLOSED BACK shovel. Address, The Wood Shovel and Tool Company, Piqua, Ohio.

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Shovels · spades · scoops

In these famous grades . . . "Moly" (Mo-lyb-den-um) . . . "Big Fist" . . . Wood . . . Stuart . . . Piqua

(Advertisement)

80,000 Sq. Ft. Rolled 6 Times in 8½ Hours

On a recent job in West Texas a test section of 4,000 feet (20 feet wide) was set aside for a test of rolling with a new type of roller, by Contractor Ernest Loyd. The road was in Lubbock County on State Highway 24. A triple asphalt surface treatment construction was used.

The Highway Department of Texas uses local materials, so far as possible. Hence on the plains of West Texas, near Lubbock local deposits of caliche are utilized as a base for the asphaltic wearing surface, for which crushed stone is also secured locally. Caliche is a calcareous soil or rock soft enough to be plowed or excavated without explosives.

The caliche was placed on a subgrade first prepared, shaped and rolled to true uniformity, crown and grade. It was placed in two courses, each of 4½ inches compacted thickness. Side forms set accurately to grade, together with measured quantities of materials per 100 foot station, were employed to assure regularity of thickness. The caliche was first shaped dry by blading to conform to typical cross section, and compacted by rolling; then by successive watering, rolling, blading, and re-rolling, it was made dense as possible and was brought to true crown, grade and specification smoothness, ready for the surface treatment.

Cementing Value

Under the prairie winds, the thermometer registering 100 degrees to 105 degrees, the caliche dried very quickly. It was therefore important that as soon as the stickiness disappeared after watering, the roller should, as rapidly as possible, perform its work of compacting. Taking advantage of the fact that with the Roll-A-Plane the center roller accomplishes a major portion of the work of compaction it was not necessary to lap the rear wheels as is customary with the ordinary roller; hence the entire surface could be rolled in a minimum length of time, or while it was in prime condition for compaction.

Blading and shaping the base was done with a tractor-drawn grader and a multiple blade road planer, followed, after watering, by the Roll-A-Plane.

The caliche base thus produced was a perfect plane longitudinally and true to crown as was shown by rigid inspection with straight edges and templates used under the direction of Guy R. Johnson, Division Engineer, and his co-workers, Lon C. Ingram, Jr. and Alex Smith.

Upon the caliche base as prepared, and after thorough sweeping, there was applied a 0.3 gallon per square yard treatment of the asphalt heated to a temperature of not less than 325 nor more than 375 degrees Fahrenheit.

The No. 1 stone, (1" to 1¾") previously stored in piles along the shoulder, was then spread over the asphalt at the rate one cubic yard of aggregate to 33 square yards of surface. After as thorough distribution as possible by hand, a final leveling and equalizing of the surface was given by means of a horse-drawn broom drag, passing once in each direction over any given area.

No Low or High Areas

The brooming was followed by the Roll-A-Plane which on account of the smoothness of the base, as well as the even distribution of the aggregates, was able to operate from the very first with the center roller in its "plane" position. Not in the entire 4000 foot length was either the center or the front rollers observed to cease rotating on account of low or high areas. Here the advantages of a perfect base, of careful workmanship and trained supervision, of the even distribution of aggregates by the

(Advertisement)

broom drag, and of the leveling effect of the Roll-A-Plane must all be given credit for the excellent results secured in the final finish of the No. 1 course.

Two alternating courses of hot asphalt and crushed stone were applied, brooming and rolling each as before, when the road was at once opened to traffic.

Before the test was made on the triple asphalt surface treatment, there was an apprehension on the part of some of the engineers that the Roll-A-Plane would not be able to function properly on this rigid type of construction, as there would be no chance for movement of the component aggregates of the thin mat coat.

It was found to be true that the Roll-A-Plane produced little or no lateral movement of the aggregates, especially on the No. 1 course, but if used from base course to finished surface, and supported by otherwise good workmanship, it does away with all necessity for such movement and produces most commendable results.

(Advertisement)

While the test was in progress, the Roll-A-Plane was used on an adjacent section for the rolling of No. 2 and No. 3 courses, the base and No. 1 course of which had been rolled by an ordinary three wheeled roller. On this section, numerous high spots were encountered which made it necessary either to raise the plane roller or to back off and take another run or two for the high spot. The No. 3 course, however, was ironed out with much less effort than the No. 2 course. This experience demonstrates very clearly the superiority of the Roll-A-Plane as a leveling and compacting agency as well as the advantages of using it exclusively during all stages of construction.

Triple Asphalt Surface

The triple asphalt surface treatment type of construction, should not be considered as three distinct layers of surfacing materials. In reality, the medium sized No. 2 aggregate is keyed into the coarser No. 1; likewise, the finer

(Advertisement)

No. 3 is keyed into the No. 2 making a mat that will be self-sealing under traffic. The mat should be dense in order to exclude moisture and preserve the base. It should be precise in thickness, to prevent buckling or movement under the impact of traffic, and for the sake of riding comfort, it should be smooth, or level. All these qualities are imparted to the respective surfaces by the use of the Roll-A-Plane.

Continued passages of a heavy roller over this type of surface tends to produce undue rupture of the aggregates hence it is important that the stone should be perfectly keyed in place, and leveled by the least damaging, yet most efficient means. It was found that only two passages of the plane roller over any given area were necessary to produce the required result.

The entire surface, 4,000 feet by 20 feet, was covered twice each course (six times in all) by the Roll-A-Plane. For these operations the total rolling time was 8 hours and 30 minutes.

SOLVE SECONDARY HIGHWAY PROBLEMS

with **AUSTIN-WESTERN**
Hydraulic Blade Graders

● C. R. Craig, Engineer of Appanoose County, has light graded 125 miles of secondary road during 1934 in spite of limited appropriation.

Appanoose County, Iowa, with a rural population of 16,668 and a total population of 25,000, maintains 902 miles of secondary roads. Under such conditions it is easy to see that the most economical method of bank sloping, ditching and maintenance must be followed in order to maintain the entire road system.

The Austin-Western No. 12 Blade Graders with hydraulic controls are the most recent addition to the county's highway equipment. The graders because of their easy control and speedy operation have proved more effective than the old hand-control machines which are being disposed of as rapidly as possible.

Contractors and highway engineers who are faced with similar problems of highway construction and maintenance should know the features of Austin-Western Graders that lead to low cost work.

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The high lift blade of the Austin-Western No. 12 Grader on the first round against a high bank.



The soil of Appanoose County is chiefly gumbo and clay. Note the weight and bulk of the wind-row on this cut.

The Austin-Western Road Machinery Co.
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Please tell me more about Austin-Western ☐ 8' ☐ 10' ☐ 12' Blade Graders.
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Two Rock Tunnels Join Coast Counties

The new Broadway low-level tunnel project, between Alameda and Contra Costa Counties in California, will replace the old tunnel road and make Contra Costa County centers into suburbs of Oakland, bringing the slopes of Diablo within easy commuting distances of the Ferry Building. The project, being speeded to completion by the Six Companies, also builders of Hoover Dam, will require excavation of more than 1,000,000 cubic yards of rock and earth, 1,000 tons of structural steel will be used, together with 2,500 tons of reinforcing steel and 120,000 barrels of cement. More than 700,000 square yards of oiled macadam pavement, 8 inches thick, will be laid.

The new route, ultimately to become part of an Oakland-Stockton highway, at least 10 miles shorter than the present Dublin Canyon Road, comprises two one-way tunnels, each 3,168 feet long, 25 feet wide and 34 feet high. The bores are 15 feet apart at the portals and are separated by 100 feet in the center. The broad approaches are to have four traffic lanes.

Adequate ventilation is assured by an elaborate electric ventilating system including eight huge fans located in reinforced concrete structures at the portals. These fans will pump in 1,500,000 cubic feet of fresh air a minute, and eight exhaust fans will pull out an equal amount of foul air.

Illumination in the tunnels will be furnished by powerful electric lights located every 1,500 feet. Romaine W. Myers, consulting electrical engineer on the project, has worked out light transition sections which will adjust the eye of the motorist to the difference between sunlight and artificial light at both portals.

Concrete Hauled Dry

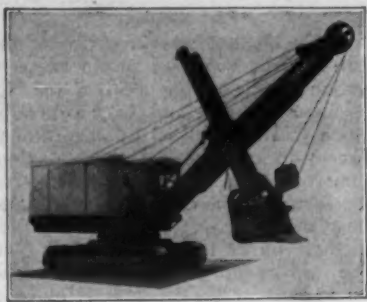
In the handling of concrete for the tunnel, a fleet of Ford V-8 batch trucks is employed for hauling batches of dry material from the plant at Emeryville to the project where water is added and the mixed concrete poured into the forms. There are eleven boulevard and railroad stops on the 5-mile truck haul and then a steep drop from the tunnel road to the project. Engine power, clutch strength, as well as brake power are demonstrated in this haul and particularly when heavily loaded trucks back up the steep ramp to the top of the concrete chute at the west portal.

The huge East Bay highway undertaking represents many years of planning by the Alameda-Contra Costa Highway District. The cost of the Broadway low-level tunnel project will be \$3,683,931. Of this amount 30 per cent was provided by PWA, the State of California contributed \$300,000 and pledged \$400,000 additional. The Highway District issued \$2,378,000 worth of bonds.

New 1 3/4-Yard Excavator

This time it is not the Fire Chief who is claiming the headlines, but the Osgood Chief, the new 1 3/4-cubic yard power excavator just announced by the Osgood Co., Marion, Ohio. The new unit is designed for use as a shovel, dragline, clamshell or crane and is readily converted in the field.

As a shovel it has either the well-known Osgood wire rope crowd of the positive type, or the new Osgood independent chain crowd. In either case, the boom angle can be changed to suit the working conditions without adjustment of any kind other than the necessary raising or lowering of the boom by the power boom hoist. The boom is a single steel member, box section, with steel diaphragms and with foot castings



The New Osgood Chief

of unusual size and strength. The dipper handle is of the outside type, with full length plates and bars filled with white oak, and securely through-bolted.

All levers and foot pedals are located to best possible advantage, the leverage being such that a minimum of physical effort is required. The main hoist and auxiliary clutches are set by power, and all operating levers toggle in. The operating machinery lies back of the center line of rotation for balance and all high

speed machinery shafts are carried on anti-friction bearings and the low speed shafts in bronze bushings. The Osgood Chief is available with gasoline engine, diesel engine or single electric motor drive. The truck frame or crawler base is made up of one piece steel castings, the rotating gear has machine-cut teeth,

is large in diameter and securely attached to the main body housing. The crawler treads are of manganese steel alloy. Steering is under full control of the operator who is protected by the steel cab but has a full view of his work through glass windows with steel frames.

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The recent burning of the Logansport Bridge over the Sabine River between Texas and Louisiana emphasizes the need for all steel construction because of its firesafe qualities. This was a steel bridge, it is true, but vulnerable in its wood approaches, supports and flooring. • Several new Carnegie developments now provide this all-steel construction.

T-Tri-Lok and I-Beam-Lok assure a fire-proof, armored, anti-skid surface of long life and high efficiency. CBP Sections, designed particularly for bearing pile service, are suitable for any installation, but especially efficient where deep penetration is required and driving conditions are severe. Let us work with you on your next design.



I-Beam-Lok ready for concreting on East Grand Boulevard Viaduct over the Grand Trunk Railway lines, Detroit.

Showing excellent condition of fabricated steel bearing piles after thirty-five years of exceptionally severe service.



Combined bearing piles and trestle bant members on approaches to the recently completed bridge at Leeper, Mo.

CARNEGIE STEEL COMPANY

PITTSBURGH U.S. STEEL PENNSYLVANIA

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GRAND the resurfacing of a contract as a resur Northern expense, sections of heavily tr for 3 year 1934, whe imperative mental sec engineers base by t

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Late in partment Avenue, These str through border) Avenue i principal

The h was limit was not and Fifth an additi of pavem old surfa two bloc 30 feet i 7-inch co curb.

City a the contr mental s ried on a City Eng

Contractor's Sample Brought Big Contract

Experimental Pavement Four Years Old Proved Method of Resurfacing

GRAND FORKS, North Dakota, is in the midst of a 65,000-square-yard resurfacing program as a direct result of a contractor's confidence in concrete as a resurfacing material. In 1930, the Northern Construction Co., at its own expense, laid two small experimental sections of concrete resurfacing on a heavily traveled street. It was watched for 3 years by city officials. Then, in 1934, when street improvement became imperative, the success of the experimental sections persuaded city and state engineers to salvage the old concrete base by topping it with new concrete.

Old Wood Block Too Rough

Nearly all the older pavements in Grand Forks were built during the period when wood block was a popular surfacing in the northwest. This material had many excellent characteristics, but the old pavement had become so rough-riding that it could no longer be tolerated for modern traffic.

The blocks were laid on a 7-inch concrete base, still in such good condition that it seemed wasteful to tear it up. The economical remedy seemed to be removal of the blocks and resurfacing of the base with some material that would meet the demands of modern traffic. It was this thought which led to the experimental resurfacing.

The Experimental Section A Contractor's Gift

The experimental sections had an area of 52 and 53 square yards respectively and were located in front of the Northern Pacific station. When the wood block surface was removed, the base was found to be uneven, but good except in one corner where it had broken at a catch basin. The uneven base was smoothed up with cement grout varying from $\frac{3}{8}$ to $2\frac{1}{4}$ inches in thickness and the broken area was replaced with new concrete. Then the grout covered base was painted with Curcrete to prevent bond with the new top and a layer of concrete 4 inches thick, reinforced with round bars $\frac{1}{2}$ -inch in diameter spaced 4 feet center to center in each direction, was laid over it. After trying harsher proportions, a 1:2:2.67 mix was used.

After 4 years of heavy traffic and severe weather, in spite of the pounding the edges have received when wheels have bounced on them from the abutting, uneven wood block, the experimental sections are in perfect condition. They have demonstrated to everyone's satisfaction the feasibility and worth of concrete resurfacing.

Repaving on City Streets

Late in 1933, the State Highway Department decided to repave De Mers Avenue, Fifth Street and Belmont Road. These streets carry U.S. 2 (the first through route south of the Canadian border) and U.S. 81, and De Mers Avenue is, at the same time, the city's principal business street.

The highway department pavement was limited to a width of 30 feet, which was not enough for De Mers Avenue and Fifth Street. So the city paid for an additional 20 feet to make 50 feet of pavement, which was the width of the old surface. On Fifth Street a section two blocks long was widened from the 30 feet it had been to 50 feet with a 7-inch concrete pavement and integral curb.

City and state contracts were let to the contractor who had built the experimental sections and the work was carried on as one contract. The Assistant City Engineer, J. H. Turner, was also

made Resident Engineer for the state.

Preparing the Old Base

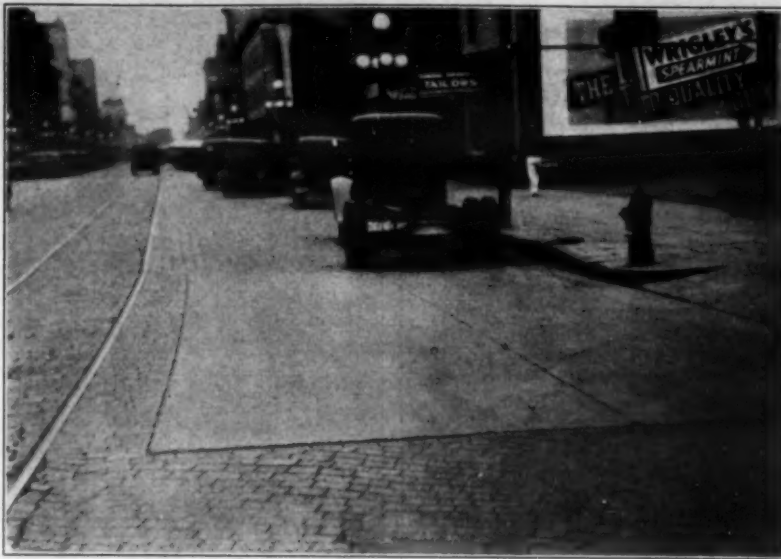
The old wood blocks were first loosened with a plow pulled by a tractor. Some of these were stored, for use in repairing other streets, and the rest were given to citizens who used them as fire wood.

The base was not leveled with grout as in the experimental sections. Instead, it was swept clean and sprayed with cut-back asphalt, which prevented absorption of water from the new concrete and is believed to be largely responsible for the complete absence of hair checking.

Resurfacing Methods

The resurfacing was made a minimum of 5 inches thick and averaged $5\frac{1}{2}$ inches. Proportions were 500 pounds of cement to 1,200 pounds of sand and 1,690 pounds of gravel, about 1:2 $\frac{1}{4}$:3 $\frac{1}{4}$ by volume, with $5\frac{1}{2}$ gallons of water per sack of cement. The cement factor was 6 sacks per cubic yard. Rein-

(Continued on page 23)



It Pays to Advertise—Both Gum and Concrete. The Experimental Section of Concrete Resurfacing in Foreground Led to 65,000 Square Yards of Resurfacing in Grand Forks, N.D.

HERCULES



DIESEL ENGINES

• Sturdy ... dependable ... compact ... light in weight, Hercules Diesel Engines continue steadily to gain favor ... for like all Hercules Engines, they deliver power faithfully and economically.

HERCULES MOTORS CORPORATION, CANTON, OHIO, U. S. A.
MANUFACTURERS OF HEAVY-DUTY INTERNAL COMBUSTION ENGINES AND POWER UNITS
FROM 6 TO 200 HORSEPOWER

Concrete Pumped 750 Feet for Dam

(Continued from page 1)

for pumping was possible. In order to secure the best results and to keep the pipe full of concrete a restrictor or spring check valve was placed on the end of the line when the discharge was well below the elevation of the pump.

Concrete of the specified proportions and 2-inch slump was delivered to the agitator immediately above the pump. This agitator driven by a LeRoi engine replaced two men who had previously been required to keep the concrete in the supply hopper agitated. The Pumpcrete machine itself was powered with a Waukesha engine. In starting the initial concrete for any pour, 0.9 cubic yard of grout was poured into the agitator. In the pipe line below were placed two "go devils" with a wad of sacks between them. They and the grout were pushed through the 7-inch steel pipe to lubricate it.

Preparation of Aggregate

All of the aggregate was excavated from borrow pits on either side of the valley at distances varying from a few hundred feet to $\frac{1}{4}$ to $\frac{1}{2}$ mile north of the dam site and hauled by truck to the aggregate crushing, screening and washing plant located at the east end of the dam. The trucks dumped through a rail grizzly which removed all stone over 12 inches in diameter. The material passing the grizzly was delivered to a scalping screen with 2-inch holes by an apron feeder. The fines were delivered direct to a bucket elevator and the oversize to a 30 x 42-inch jaw crusher, the product of which was also delivered to the bucket elevator.

At the top of the bucket elevator the material was delivered to a sheet iron apron where a stream of wash water under high pressure cleaned the material and pushed it into the circular screens which had 1-inch, $1\frac{1}{2}$ -inch, 2-inch, and $2\frac{1}{4}$ -inch openings. Over 5 feet of the $5\frac{1}{2}$ -foot 1-inch screen, a $\frac{1}{4}$ -inch sand screen was fastened to separate the coarse aggregate from the fine. Screened material up to $1\frac{1}{2}$ -inch was used for Class A concrete, and up to 3-inch for Class B concrete, separation being made by blocking off the chutes



C. & E. M. Photo
The Single Pump Which Handled
Most of the Concrete for the Project

immediately below the $1\frac{1}{2}$ -inch section of screen. The sand which passed the

$\frac{1}{4}$ -inch screen was passed through a scraper washer which delivered it to a stock pile alongside. The crushing plant was run by a Buda Model FR 4-cylinder gasoline engine. The screening plant was run by a separate engine.

From the stockpile the aggregate was moved by a Speeder Machinery Co. crane and a 1-yard Owen bucket delivering to the Heltzel 3-compartment bin, the batchers of which were equipped with Kron dial springless scales. A Heltzel trailer bin with Kron scales was used for weighing out the Lehigh bulk cement which had been hauled $4\frac{1}{2}$ miles from New Hartford by truck.

The batches were mixed in a Rex 1-yard mixer driven by a Waukesha engine with the following average weight of material per batch.

The average weights of materials for Class A concrete were:

Cement	483 pounds
Sand	1,350 pounds
Stone	2,140 pounds

The water-cement ratio was 0.90, or $6\frac{1}{4}$ gallons to the bag

The average weights of materials for Class B concrete were:

Cement	483 pounds
Sand	1,340 pounds
Stone	2,180 pounds

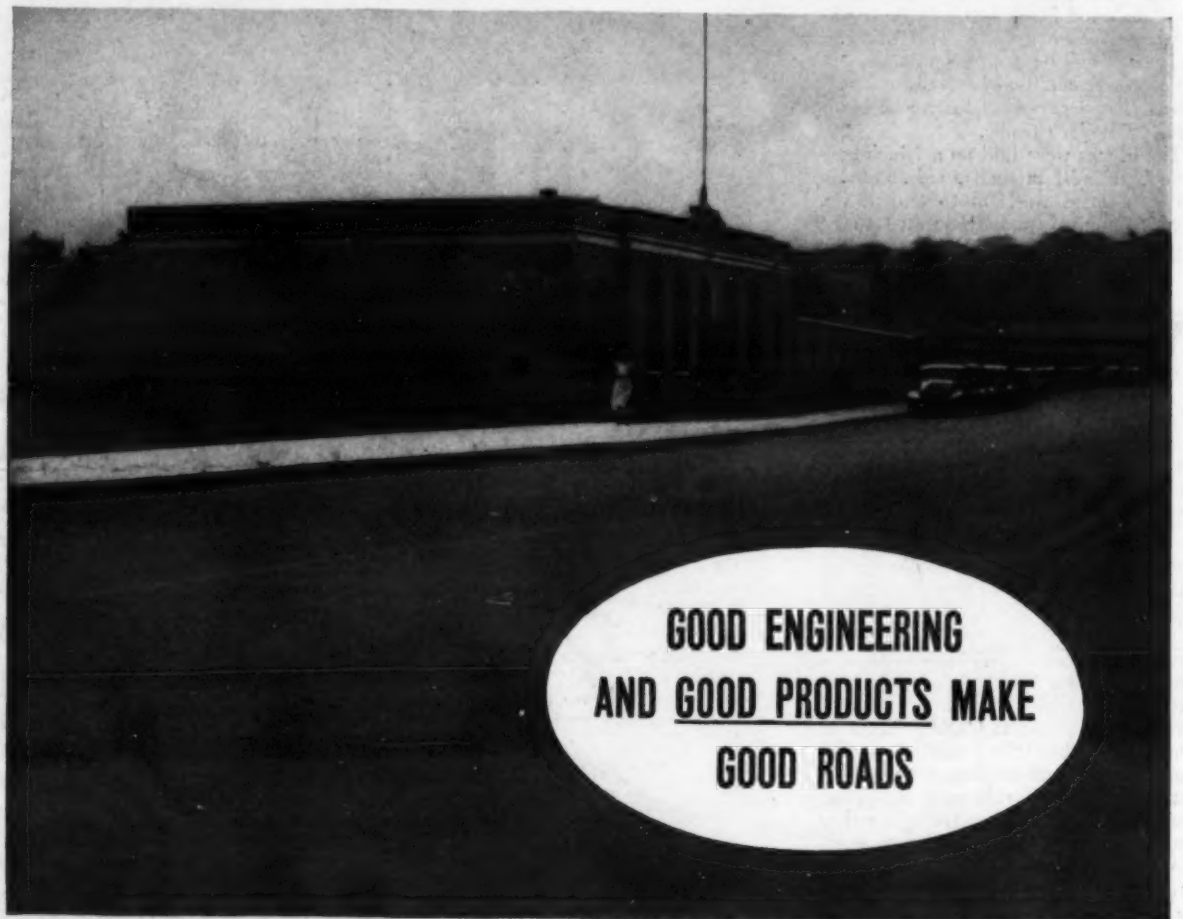
The water-cement ratio was 1.00, or 7.5 gallons to the bag

A 6-inch Domestic centrifugal pump powered with a Waukesha motor was used to supply water for washing the aggregate for the mixer, for wetting the fill and for washing down the rock in the core trench before pouring.

Excavation and Backfill

Using the overburden, which varied from 6 feet to 30 feet in depth, and some of the early rock excavation, upstream and downstream cofferdams were built with loam facings to make them water-tight. The overburden was excavated with four Lorain 75B and one Byers shovel. All of the excavation, both rock and earth, was used for backfill which was completed with material from borrow pits. The excavated rock placed in the backfill added weight to the consolidated fill and was used also to form a rock drain on the downstream side along the old river bed. Most of the excavation was hauled out by truck,

(Continued on page 17)



STANDARD ASPHALT BINDER "C." SOCONY BRAND, PENETRATION MACADAM. THE BATH HOUSE, NEWPORT, RHODE ISLAND.

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Mobile Units Aid Road Maintenance

Portable Distributors and Hand Rollers Facilitate Work in California

By JOSEPH C. COYLE

HAND ROLLERS made up in the shops of the California Division of Highways at Sacramento are a great aid to maintenance crews on California highways, and are passed around from section to section as needed for repair work. They are mounted on Ford truck wheels by bolting the hub to an 18-inch section of 1 x 6-inch plate at each end of the Pacific roller, one end of the plate being attached to the axle of the roller and the other end connected by a rod, with pipe spacer and a nut on each end. A burlap brush is sewed to this pipe to keep pre-mix from adhering to the roller on cold mornings.



Two-wheel Distributor for Patches

The wheels and roller weigh approximately 625 pounds each. A hitch is welded to the tongue so that the roller travels on the highway as a trailer, behind the pre-mix truck. Arrived at the job, a 6-foot extension handle is screwed on the end of the tongue, which is equipped with a threaded collar for the purpose. The roller is turned over so as to carry the wheels and is then ready for use. When moving a short distance, without rolling, it is turned up on the wheels, and moved by hand. If rolling is unusually hard, as on a thick fill, the roller is sometimes pushed by placing the handle against the front of the truck. In rolling close to the curb or other obstruction, one of the wheels is removed by detaching the four hub bolts.



One of the Hand Rollers in Use
Asphalt for Patches

A small portable two-wheel distributor, with an air pump on the front and an extra barrel of cut-back or emulsified asphalt binder on the back end, is used in spraying the area to be patched, after it has been swept clean. A 50-foot hose, with pressure regulated at the nozzle to give the proper spray, is used. Only four to five men are required to operate both distributor and roller on ordinary patch work and excellent time is made.

The illustrations show the crew of C. B. Jolley repairing shoulders on Orange Street, near Redlands, California. J. E. Stanton is District Maintenance Engineer and E. Q. Sullivan is District Engineer.

36-Foot Arc Welded Sphere Shows No Leaks on Tests

The 36-foot steel sphere assembled by electric arc welding and designed by the Chicago Bridge & Iron Works for the General Electric Co. plant in Cleveland, Ohio, showed no leaks when tested upon completion. This Horton-sphere is used to contain natural gas to maintain pressure and the Btu constant at all times. The sphere has a volume of 24,400 cubic feet, but at its normal working pressure of 29 pounds per square inch, its storage capacity is an additional 50,000 cubic feet.

In construction, the steel was cut to size and formed in the shop, hauled to the job, hoisted into position, and welded in place. Two General Electric 400-ampere, single-operator welding generators were used to produce the 800 linear feet of welding required in the erection of the sphere, whose steel walls are approximately 5/16-inch thick.

Following completion, the sphere was tested in two different ways for pos-

sible leaks. In the first, the conventional soapy water test was used, and in the second test, a pressure of 38 pounds per square inch was put on the sphere and held for 48 hours. A recording pressure gage on the sphere recorded pressures throughout this test, and a record of temperatures was kept in order that pressure changes due to changes in temperature might be taken into account. As recorded above, neither test showed the slightest trace of a leak.

1934 Tentative Standards Issued by A.S.T.M.

The American Society for Testing Materials has issued its 1934 book of tentative standards. This is the only volume containing all of the A.S.T.M. tentative specifications, methods of tests and definitions of terms covering engineering materials and the allied testing field. These tentative standards, issued as proposed standards, embodying the latest thoughts and practices, find important application throughout

industry. Copies in cloth binding at \$8.00 each, or in heavy paper at \$7.00, may be obtained from A.S.T.M. headquarters, 260 So. Broad St., Philadelphia, Pa.

MUNSELL Vibrating Screed Board

Provides an economical method of compacting the concrete in the slab

The Vibrating Screed Board, designed to meet the requirements of low slump specifications, may be used either with or without a finishing machine. Concrete having a 1-inch slump placed with the Vibrating Screed Board produces sufficient mortar to insure a good finish.

Write for Circular.

MUNSELL CONCRETE VIBRATORS

999 West Side Ave., Jersey City, N. J.

The Koehring Wheel Dumptor for hauling · dumping · spreading

SHUTTLE OPERATION —
Because of three speeds forward or reverse—no turning necessary.

SECONDS SAVED —
Because of instantaneous gravity dump—drive to the fill and dump.

KOEHRING COMPANY
MILWAUKEE Division of National Equipment Corporation WISCONSIN

Golden Gate Bridge Cable-Laying Equipment

Equipment for laying the cable on the new Golden Gate Bridge is now being assembled. The tramway drives each consist of four separate units: the first or preliminary drive, consisting of two sets of herringbone gears with an internal-external gear clutch between them; the second, a planetary system of four sets of double planet gears to a ring gear in the main drum casting; the third unit, the hoist drum; and the fourth, consisting of a winding spool on each side of the drum.

The four shafts and gears in the preliminary drive are all in the same horizontal plane. A 100-hp motor drives one of these shafts at 1,740 rpm, and a second 100-hp motor drives another at 870 rpm. At low speed both motors will operate, but provision is made to allow the use of only one. The layout is so arranged that it will be possible to couple one of the motors to the fourth shaft, and drive direct to the pinion of the planetary system when running on light-duty work. This first unit will be lubricated with S.A.E. 60 oil, pump fed to all the gears, the bearings being supplied with the same lubricant.

The winding spools will only be in use when the hoisting drum is not operating. The center line of these spools has been brought directly over the center line of the bearings, and balancing the internal gear load avoids gear loads on these bearings when either the drum or the spools are in operation. The winding spool bearings, however, will be required to take heavy loads, as the cable is wrapped around the winding spools with a tension of 20,000 pounds on each cable and a differential cable pull of 5,280 pounds on one spool and 8,920 pounds on the other. This brings the actual loads up to 45,280 pounds and 48,920 pounds respectively, which in view of the relatively limited space available imposes severe stress on the bearings.

All the equipment used by the John A. Roeblings Sons Co. of Trenton, N.J., in laying the cables on this California bridge will be 100 per cent Timken bearing equipped.

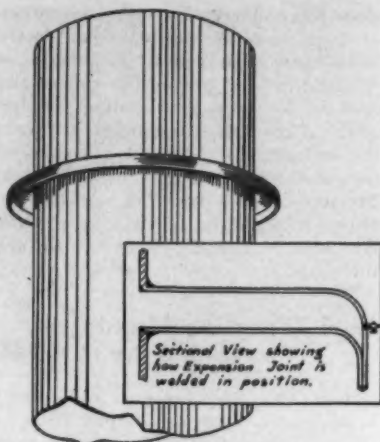
New Smooth Suction Hose

A new type of construction for suction hose has been developed through the use of a woven tubular reinforcement of strong cabled cotton cords and wire, giving a strong, lighter non-collapsible hose. This new hose, made by the Electric Hose & Rubber Co., Wilmington, Del., has a smooth lining of specially compounded rubber which is long lived and offers minimum resistance to flow. If the hose is accidentally crushed, it can be quickly restored to shape by the use of a vise or mallet. It can be connected to standard couplings on the job and does not require soft ends on the hose. This Delmar suction hose is made in all sizes up to 4 inches inside diameter and can be used in practically all types of suction hose service.

Collar Expansion Joint On Milwaukee Air Duct

An ingenious method of taking care of expansion in a long pipe line has been used at the Milwaukee sewage disposal plant at Jones Island, Milwaukee, Wis., where flanged connections permit enough flexibility to prevent distortion of the pipe under longitudinal stresses.

This tube installation of Plykrome, a stainless clad steel, ranges from 2 to 5 feet in diameter. It was assembled at



General and Sectional View of Expansion Joint

the Island in 54-foot lengths where it was welded into a continuous tube 1,800 feet long. As the tube carries 100,000 cubic feet of air per minute under a pressure of 10 pounds per square inch, the joints were welded with particular care. The Cream City Boiler Co., contractor for the work, used P & H-Hansen welders made by Harnischfeger Corp., Milwaukee, Wis., in the fabrication and installation of the pipe.

The new type of expansion joint, made under patents held by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., was installed at intervals of 54 feet. The elastic element is subject to stresses due to both internal pressure and movements of the joint, these being almost entirely bending stresses, with little direct tensile or compressive stresses. As shown, ample space is provided for longitudinal expansion of the pipe due to wide temperature variation.

Peoria Machinery Show a Big Success

More than 25,000 contractors, municipal officials, distributors and others interested in road building, logging and similar equipment visited the Machinery Show held by the Caterpillar Tractor Co. in its display rooms in Peoria, Ill., last month. The show was originally scheduled for January 8-20 but was kept open until January 31 in order to give more people a chance to see it.

Scores of contractors and highway officials stopped off on their way to the American Road Builders' Convention and the A.G.C. meeting in Washington during January. Nearly thirty foreign countries were represented by visitors to this show, some of these dealers and representatives journeying from such distant points as New Zealand, Malaya and South Africa.

Fifty manufacturers participated, nearly three acres of floor space were given over to the exhibits and over \$500,000 worth of equipment was on display. Tractors, shovels, draglines, compressors, dirt movers, road machinery and diesel engines were featured, as well as many tiny models of giant machines.

The list of exhibitors follows: Athey Truss Wheel Co.; Ajax Mfg. Co.; All-steel Products Mfg. Co.; American Hoist & Derrick Co.; American Tractor-Equipment Co.; Anthony Co., Inc.; Baker Mfg. Co.; Bay City Shovels, Inc.; Blaw-Knox Co.; Brookville Locomotive Co.; Browning Crane & Shovel Co.; Bucyrus-Erie Co.; Burgess Battery Co.; Byers Machine Co.; Davenport-Besler Corp.; Davey Compressor Co.; Deere & Co.; Diamond Iron Works; Electric Wheel

Co.; Fate-Root-Heath Co.; Gardner-Denver Co.; Gar Wood Industries, Inc.; General Electric Co.

Harnischfeger Corp.; Hester Plow Co., Inc.; Hopper Machine Works, Inc.; Iowa Mfg. Co.; John Chattillion & Sons; Killefer Mfg. Co.; King Plow Co.; Koehring Co.; LaPlant-Choate Mfg. Co.; R. G. Le Tourneau, Inc.; Link-Belt Co.; Manitowoc Engineering Works; Marion Steam Shovel Co.; Master Equipment Co.; Muskogee Iron Works, Inc.; Northwest Engineering Co.; Ohio Power Shovel Co.; Osgood Co.; Pioneer Gravel Equipment Mfg. Co.; Sauerman Bros.; Schramm, Inc.; Service Recorder Co.; Silent Hoist Winch & Crane Co.; Speeder Machinery Corp.; Standard Steel Works; Sullivan Machinery Co.; Thew Shovel Co.; Tractor Plow Co.; Universal Crusher Co.; Willamette Hyster Co.; Worthington Pump & Machinery Co.

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ROGERS as usual have something entirely NEW!! HEAVY-DUTY TRAILERS on PNEUMATIC TIRES

These trailers are equipped with 10 pneumatic tires with carrying capacity from 10 to 40 tons. The rear assembly is equipped with 8 pneumatic tires on 4-rocking axles, which allows the load to be equally distributed on each of the 8 rear tires. These trailers like all other ROGERS are low in construction and up-keep.

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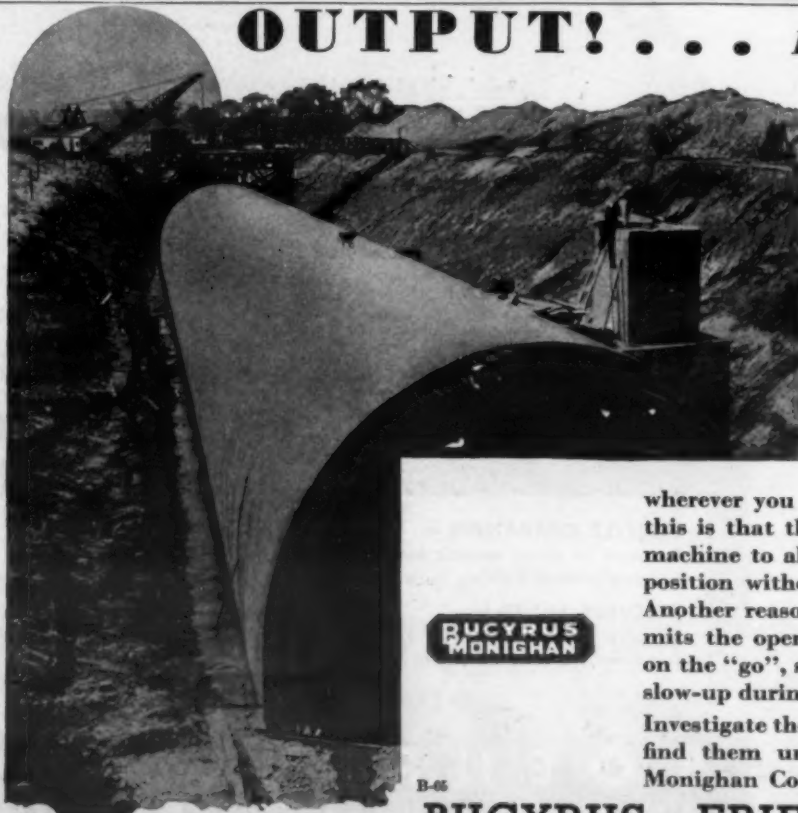


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108 Orchard St.,

ALBION, PA.

OUTPUT! . . . Regardless of the "Lay of the Land"



HERE the Bucyrus-Monighan Walker is piling up record output on a mammoth concrete sewer, but it's a "go-getter" on any job. Neither size nor working conditions can stop it.

Filling, swinging, dumping—tirelessly and without a pause—the Walker brings home the output bacon

wherever you put it to work. One reason for this is that the walking traction permits the machine to always keep in its best operating position without wasting time or movement. Another reason is ease of control, which permits the operator to keep the bucket always on the "go", smoothly and without noticeable slow-up during or between cycles.

Investigate the Walker's output records. You'll find them unusually interesting. Bucyrus-Monighan Company, Chicago, Illinois.

BUCYRUS MONIGHAN

B-45

BUCYRUS • ERIE CO. • SOUTH MILWAUKEE WISCONSIN

Winter-Placed Concrete

(Photo on page 40)

Concrete temperatures are the controlling factor in successful winter work; air temperatures are important only as they affect the initial heating of the concrete materials and the protection required against heat loss. Results depend upon how effectively concrete temperatures are maintained and upon the time required by the cement to provide service strength.

Heat-protection methods depend upon air temperatures. For simplicity, sub-normal air temperatures are classified on the basis of mean temperatures from sunset to sunrise as follows:

1. Cool—night temperatures average 50 degrees
2. Cold—night temperatures average 33 degrees
3. Sub-freezing—night temperatures average 16 degrees

A very complete table giving suggested periods of heat curing and protection methods for various types of structure for these three typical exposure conditions has been prepared by the International Cement Corp., 342 Madison Ave., New York City, and is included in its pamphlet, "Winter Construction with Incon 24-Hour Cement."

Cool-Weather Concreting

In late spring and early fall, unheated concrete is cool when placed; if unprotected, it loses heat and hardens but little during the first night,—the critical period for early strength. Some precautions should be taken; usually it is sufficient to heat the mixing water and promptly protect the placed concrete. A 5-degree rise in temperature of mixing water produces a rise of approximately 1 degree in concrete temperature. Thus, if concrete temperature is to be raised 20 degrees, water temperature should be raised 100 degrees.

Cold-Weather Concreting

When mean night temperatures fall below 45 degrees, additional precautions are necessary. Both mixing water and aggregates should be heated, the amount of heat depending upon conditions. In all cases, be on the safe side—don't take chances! Water may be heated up to 150 degrees and the aggregate heated as required. If water is heated above 150 degrees, and in no case above 180 degrees, put the water and aggregates in the mixer first. Then after the drum revolves a few times, add the cement. In this way, rapid stiffening of the mix will be avoided.

Flat work, such as pavements and large masses, should be promptly and effectively covered. For structures above ground, apply heat inside the enclosure, preferably using exhaust steam. Exposed surfaces, particularly angles, pilasters, lintels, buttresses, etc., should receive special attention.

Under cold weather conditions it does not pay to maintain temperatures lower than 70 degrees during curing; it is



Plenty of Tarpsaulin Makes a Good Housing for Steam Pipes or Salamanders to Hold Heat Around Newly-Placed Concrete

cheaper to maintain adequate heat for one day than inadequate heat for several days. If heat-protection is required, a high-early-strength cement can be used effectively.

In Sub-Freezing Weather

When mean temperatures between sunset and sunrise are below freezing, more elaborate precautions are necessary: 1. high initial concrete temperatures are required; 2. most efficient protection is necessary to avoid heat

losses; 3. higher concrete strengths must be secured to withstand the effect of freezing after heat-curing stops.

Nowhere else in the entire range of construction do sound methods and careful workmanship pay higher dividends than in sub-freezing concrete operations. By using a high-early-strength cement, costly heat protection will be reduced to a minimum and sound, lasting work assured.

Lubrication's Aid to Mechanical Progress

The machine problems in the time of that genius of the steam engine, Watt, between 1775 and 1780, were largely those of mechanical invention. Tallow oil would do for cylinder lubrication for many years. At best it only supplied a profuse amount of lubrication at irregular intervals, being applied generally as a result of distinct groaning of the valves or of the pistons.

These groans grew to menacing proportions as engines and machines were improved and their number multiplied. The machine age could not have arrived had not a satisfactory lubricant become available to win its battle against friction.

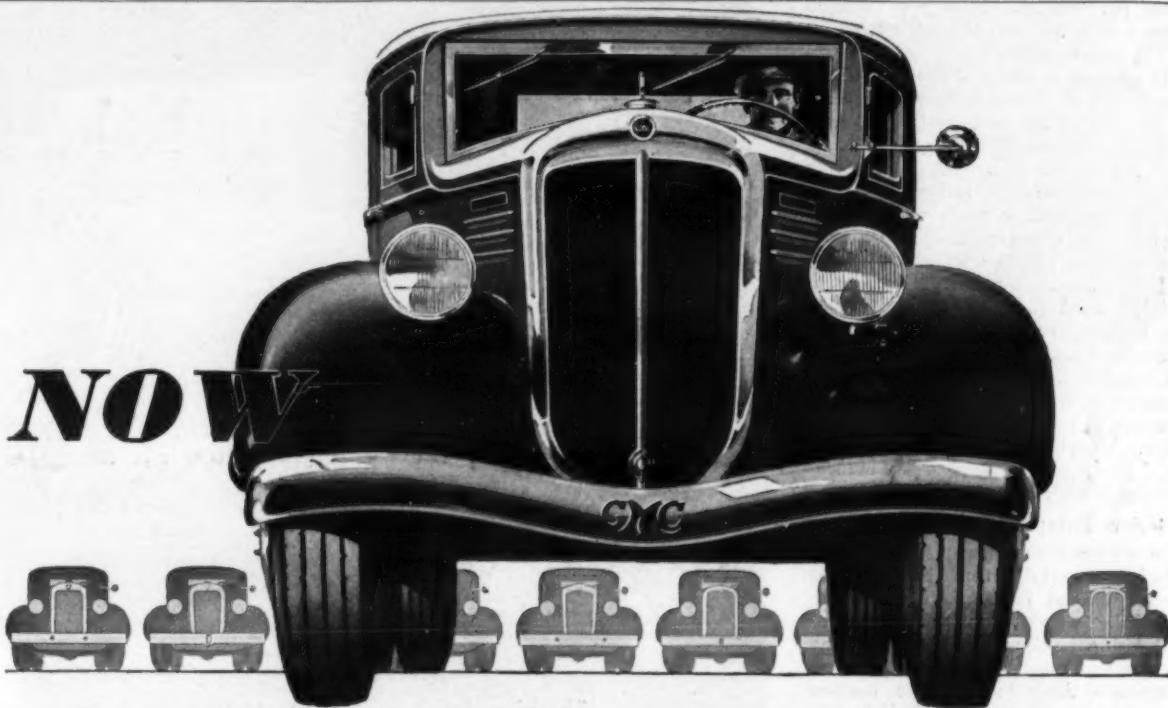
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SOUTH BEND, INDIANA



-out ahead with a wider lead than ever!

**Important 1935 improvements, including
HYDRAULIC BRAKES, assure better performance and
greater earnings for GMC truck buyers*

ON THE BASIS of comparative specifications or that of work done and profits earned, cold logic on the one hand and actual facts on the other have proved that General Motors Trucks challenge the entire field. Improvements, gradual and unheralded, have won for every unit in the entire line the confidence of an ever-increasing number of shrewd business men who judge truck value by the only sound yardstick, that of "earning ability" per dollar invested.

Now, at the start of 1935, important improvements, such as those listed below, assure still better performance, still greater economy, the ability to out-perform

and the ability to out-earn in a more pronounced way than ever before.

More and more thousands of profit-minded truck buyers are swinging to General Motors Trucks. Even in the intensely competitive low-priced 1½-ton field of usage, shrewd buyers are proving daily that it pays to invest a few dollars more for the quality-built, all-feature 1½-ton to 2-ton GMC T-16.

A phone call to your nearest General Motors branch, distributor or dealer will bring you the bedrock facts. Representative models of the 1935 GMC line are now on display.

*NOTEWORTHY 1935 IMPROVEMENTS:

Hydraulic brakes standard on all light and medium-duty models; centrifuge or cast nickel iron brake drums; exceptionally large braking surfaces; increased fuel economy; increased power; increased torque; dual performance rear axle available in 2-3 ton range; finer appearance—sloping radiator, skirted fenders, fender-mounted headlamps, drop-skirted cabs, horizontal louvers and optional group of de luxe equipment (at slight extra cost).

GENERAL MOTORS TRUCKS and Trailers

1½ TO 22 TONS

GENERAL MOTORS TRUCK CO. Time Payments Available Through Our Own Y.M.A.C. PONTIAC, MICHIGAN

A HANDY TRAILER MIXER

This 3½-cubic-foot Trailer Mixer may be loaded or discharged from either side, as it is fitted with an interchangeable lock. Ball bearing head with few wearing parts. It is easily and quickly moved from one job to the next because of its strong rubber-tired steel wheels (with 6-inch hubs). Power is furnished by a reliable 1½-hp. engine.

Write for complete specifications



The J. B. Foote Foundry Co.
Fredericktown, O.

Losing Profits Through Lost Time

(Continued from page 2)

not be overcome by overloading screens, increasing the speed of revolving screens beyond a certain limit, or using an excessive pitch. Such measures invariably result in inaccurate screening and should be prohibited by inspectors.

At several plants material coming from the dryer was dumped first on a fixed, sloping screen (scalping screen) with openings which passed all acceptable sizes and which was arranged to by-pass all oversize material and thus avoid burdening the other screens. At some plants the material coming from the dryer or scalping screen was divided equally between two rotary screens of identical characteristics. Single screens varied from 18 to 24 feet in length where 4 sizes of aggregate were required. The speed of screens varied from 6.3 to 10.3 revolutions per minute and averaged approximately 8 revolutions per minute. Diameters ranged from 5 to 6 feet and the pitch from $\frac{3}{4}$ to $1\frac{1}{4}$ inches per foot.

In general, a single screen 24 feet in length, 6 feet in diameter with a pitch of $\frac{3}{4}$ inch to the foot, and revolved 8 times per minute should produce 1,200 tons per 8-hour day.

Screened material falls directly in storage bins and these should be large enough to offset irregularities in supply and demand. The bins should be equipped with openings for discharging material, should the supply of a given size become excessive, and also for the removal of cold aggregate. The required bin capacity is closely linked with the accuracy with which the sizes of aggregate are fed to the cold-aggregate elevator. Mistakes in proportioning material in stockpiles soon become evident as trouble with bin supply.

Few Delays From Batchers

In all cases the operation of withdrawing materials from bins in the proper amount for a batch, as determined by weight, was accomplished well within the time required for mixing the previous batch. On some jobs the clogging of filler dust in chutes leading from the bin caused delay. Well-designed plants now have screw conveyors for supplying filler if it is used.

Improve Pugmill Operation

Discharge of material from the weighing box to the pugmill was done in a single operation at nearly all plants. In a few cases this practice coupled with large batches and a poorly designed pugmill resulted in the segregation of aggregate in the mix. As a corrective measure it was required in such cases that half a batch be weighed and dumped at a time. This requirement added considerably to the charging time and mixing cycle. The average charging rate on all projects was 263

pounds of material per second and the half-batch charging method lowered this rate to 127 pounds per second. On jobs using a large batch with a single charge the rate was 520 pounds per second. Such a charging rate allows ample time for the accurate weighing of sizes during almost a complete mixing cycle. A single charge is desirable to permit a short period of premixing of the entire dry batch before the asphalt is added.

The mixer is the key unit in the plant set-up. In a typical twin-shaft pugmill mixer set-up, the two shafts are of heavy steel and each mounts four groups of paddles set at 90-degree intervals. The faces of the paddles are set at 45 degrees to the plane of rotation. The two shafts rotate at equal speeds so as to force the material inward and the paddles mesh uniformly so as to entirely eliminate any dead spots in the mixer.

Some of the faults of mixers observed in the study are as follows:

1. The length of the mixer is some-

times too large with respect to its width resulting in poor end-to-end distribution of the material and confining the mixing action primarily to the planes of rotation.

2. The facing of the paddles is sometimes arranged in a haphazard manner so as to set up uninterrupted paths of flow, rather than intercepting paths of flow to cause intermingling.

3. The distance from the center of the shaft to the bottom of the mixer and the distance from the center of the shaft to the top are often too small to permit rotating of the paddles at speeds which have been found desirable for good mixing, without forcing material over the sides of the box.

4. The size of the discharge opening is frequently so small and the discharge rate so low that the paddles are adjusted to aid in discharge rather than set as a result of consideration of mixing requirements only.

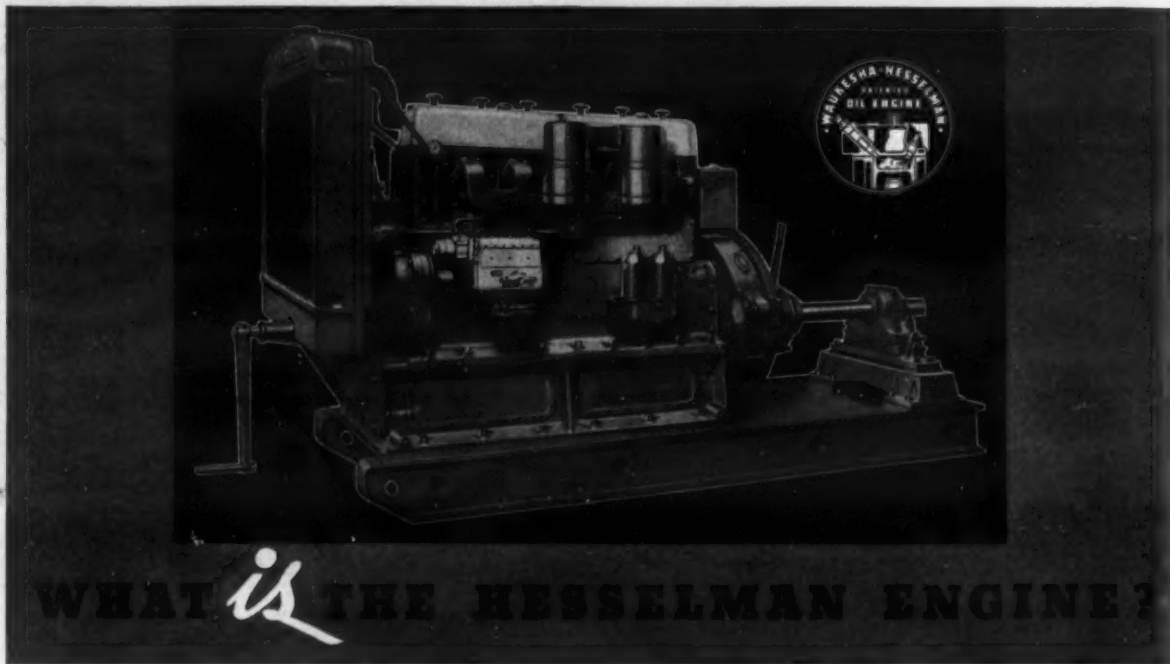
5. The speed of revolution is often too low to impart the necessary violence to the mixing action.

6. The net volume of a pugmill is sometimes reduced too much by the volume of the shafts, arms and paddles.

(Continued on page 30)

Road Show Exhibit Models Show Differential Operation

The exhibit of the Four Wheel Drive Auto Co., of Clintonville, Wis., at the Road Show in Washington last month consisted of photographs of the original and present plant and a diminutive model of the FWD chassis with all parts exposed. This model operated by an electric motor on a circular table was used to demonstrate the need of the center differential which compensates for the difference in distance travelled by the front and rear wheels. By a control, the center differential can be made inoperative and the car stops in less than one-half revolution around the table, showing the handicap which a four-wheel-drive truck would have to overcome without the use of a center differential.



WHAT IS THE HESSELMAN ENGINE?

The Hesselman is a solid injection, spark ignition engine burning Diesel fuel oils. It was invented and developed by one of Europe's three leading Diesel engineers, Mr. K. J. E. Hesselman, most of whose professional lifetime has been spent in the improvement of the conventional high pressure Diesel.

Waukesha-Hesselman Engines are not offered as a substitute for compression ignition Diesel engines, but rather as supplementary. It is an engine that expands the economic application of fuel oil power and that will fit into many places where a Diesel cannot be economically applied.

After thirty years' specialized experience, Waukesha engineers are building engines for every fuel—each the most economical in its class. This knowledge enables them to recommend without prejudice the engine best suited to the particular duty.

The Waukesha-Hesselman is recommended for industrial tractors, electric lighting and power plants, road building, logging, oil field, and contractors' machinery, marine propulsion, etc. Write for Bulletin 1000. Waukesha Motor Company, Waukesha, Wisconsin.

THIS IS NO. 1 OF A SERIES ON THE WAUKESHA-HESSELMAN OIL ENGINE
No. 2 will appear next month. A reprint of the complete series will be mailed on request

WAUKESHA ENGINES



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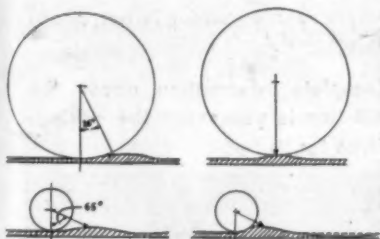
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The Practical Theory of the Small Road Roll

As field experience with the Ironer Roll attachment of the Hercules road roller, made by the Hercules Co., Marion, Ohio, has developed, it is evident that this type of device will effect a marked change in road-building methods. The rear rolls on a 10-ton roller are usually about 68 inches in diameter and the arc of contact is formed by an angle of about 26 degrees at the hub. Therefore, the lines of force of the roller are acting almost vertically. This long arc of contact permits the rolls of large diameter to rise up over a high spot. With lines of force acting vertically, if there is an excess of material, it is pushed down beneath the roll and is compacted to a greater extent, forming a hard spot which will be a source of future trouble, and then there is still a high spot to contend with.

Hercules Co. engineers discovered that when the initial rolling was done with the Ironer Roll, that is when the roller was operated in such manner as to have the Ironer Roll compact the material used for paving, there were no high spots. The explanation is simple. The Ironer Roll, being of small diameter, permits of an arc of contact with an angle of 65 degrees and with a larger force applied almost horizontally with the Hercules positive power control applying hydraulic pressure, a compression comparable with the large wheels is obtainable. With this pressure, the short arc of contact and the more horizontal application of the lines of force, the excess material in the high spots is rolled ahead of the Ironer Roll to fill up the next depression.



Above, What Happens When Large Rolls Encounter High Spots. Below, What Happens When the Ironer Roll Is used

If the first passage over the material to be rolled is made by the Roll, a smooth surface must result, due to the fact that the vertical compression of the front and rear driving wheels of the roller itself has not been applied to the material and the excess material represented by high spots is in its most mobile state.

Institute Elects Gardner

Walter H. Gardner, Manager of the Special Sales Division of Caterpillar Tractor Co., has been elected to the Board of Directors of the Internal Combustion Engine Institute as recognition of the place occupied by Caterpillar in the engine field and the success he has had in directing its engine sales.

Power-Operated Skidders Used by Jahncke Service

Jahncke Service, Inc., of New Orleans who were awarded a large levee contract at Dell River Junction in Louisiana have followed the example of other large contractors engaged in this type of work and purchased two Tom Huston skidders equipped with Fordson tractors for power. The sale was made by the New Orleans Equipment Co., 400 Jackson Ave., New Orleans, La., one of the largest distributors of truck equipment and machinery in the Deep South.

Bonneville Batcher Are Fully Automatic

Cramer Machinery Co., distributor of construction equipment in Portland, Ore., recently sold and placed in operation a complete Johnson batching and concrete mixing plant for the General Construction Co. and J. F. Shea Co. on the Bonneville Dam near Portland. This plant is completely automatic in operation with air and electric control. It has a capacity of 120 cubic yards of concrete per hour and is operated entirely by one man and a helper. Two 3-yard Davis tilting mixers produce the concrete. The weight of each aggregate that goes into a batch is recorded on a single sheet of paper, and with it the consistency of each batch in the mixer, and the time of day that the batch is mixed.

This plant is generally recognized as the most complete plant of its kind thus far put into operation. The C. S. John-



The Operator's Control Stand for the Batching Plant at Bonneville Dam

son Co. was also the manufacturer of all of the batching equipment used on

Hoover Dam and has several other large plants to its credit.

1911

—While Wooster Pike, near Cincinnati, Ohio, was being Tarvia-built, Americans were thrilled by the first transcontinental airplane flight.

1935

—Transcontinental flying has been cut from 84 hours to 10 hours in the 24 years Wooster Pike's Tarvia pavement has given flawless service.

Barrett Tarvia

Tarvia

GOOD ROADS AT LOW COST

Twenty-four years of uninterrupted service is not an exceptional performance record for a Tarvia road. Highway officials all over the country have had similar experiences with Tarvia. They know—and appreciate—that Tarvia roads are easy and economical to build, and need only the simplest and most inexpensive maintenance to make them last indefinitely, always smooth, easy-riding and skid-safe.

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 Portland, Me. Lebanon Columbus Milwaukee In Canada: THE BARRETT COMPANY, LTD. Montreal Toronto Winnipeg Vancouver

How the Other Fellow Did It

Ideas Which Have Already Proved Helpful to Contractors

Handling Marginal Bars

352. So many states now require the use of marginal bars in concrete slab that it seems strange that more contractors have not adopted the practice which we have seen on two or three jobs where the marginal bars, immediately after oiling, were placed on the brackets of the forms just off the slab. In this position they are not in anybody's way, they are kept reasonably clean and are not completely covered with dirt when it comes time to place them in their chairs within the grade just prior to concreting. 27.4.24

Keep Batch Gate Latched

353. A job we visited in Pennsylvania a short time ago had been having some trouble with the drivers of its two-batch trucks leaving the batch gate unlatched so that both batches would drop into the paver skip at one time. This is wasteful as both batches had to be shoveled from the skip and discarded. The contractor had a large sign painted and attached to the aggregate batching plant where it was in full view of the truck drivers as they approached the plant. The sign placed the responsibility for latching the batch gates directly on the truck drivers by notifying them that they would be charged for the material wasted if two batches were dropped at one time. 27.5.22

Help for the Finishers

354. A Southern contractor working on a concrete base job which required longitudinal floating equipped the double rolling bridge with a heavy bolt suspended by a wire from the rear of the bridge so that it just dragged in the concrete, leaving a fairly straight mark which served as a guide to the broom man. Thus he was able to broom-mark accurately one-half of the 20-foot concrete base to roughen the surface to provide a bond for the asphalt top without overlapping too much.

Another novel scheme to prevent argument on the amount of lap of the longitudinal floating was the insertion of a block on one side of the double bridge at the mid-point. This marked the point where the bridge was to be stopped each time to give a 50 per cent lap on each floating operation. 27.2.28

Broom Marking of Concrete Made Easier and Cheaper

355. Cruising around the New York State Capitol district, we discovered a new idea in broom marking of concrete pavement slab. New York State pioneered this method of making concrete pavements non-skid but it remained for a contractor greatly to improve the method. Standard fibre brooms with long handles are generally used for marking the pavement transversely. If the brooms are given the best of care, they may wear uniformly and thereby give an even broom marking. If some of the bristles break or become clogged with concrete, the marking is liable to be very ununiform, leaving sufficient unevenness in the pavement to be noticeable to drivers of motor vehicles.

An Albany, New York, contractor decided that he would cut his brooms in half, giving two brooms of the same length but of only half the weight so that they did not dig into the concrete but gave equally as effective surface marking. Two brooms, which were originally one, were used to broom mark 6½ miles of three-strip pavement.

502:34

Hardness Where Hardness Is Needed

356. The welding supervisor who was responsible for the reclamation work on an industrial railroad reports, "It might interest you to know that we have replaced numerous case-hardened link blocks and combination lever pins on our locomotives with a soft steel pin that has a wearing surface built up of wear-resisting bronze welding rod. After running 65,000 miles, these pins show less than 1/32-inch wear whereas a case-hardened pin would wear 3/16-inch or better."

This is an item for welders which contractors may well consider carefully. There are plenty of places on your equipment where your welder can apply a wear-resisting metal with his oxy-acetylene outfit. O.A.T. 12.34

Picks and Shovels

(Continued from page 1)

studio. The tube is 17 feet in diameter and so perfect in detail that engineering classes from California Tech and University of Southern California visited the studio in order to study it. This tunnel section represents some two months of painstaking labor by a small army of workmen and is complete down to the last bolt and nut. At the working end, an actual shield and the various working platforms and equipment used in tunnel construction have been duplicated, with a gantry, air locks and elevators at the other end.

Recognition at Last

Many professions, and also the rackets, have been portrayed and glorified on the screens of the movie houses of America. Some of them have succeeded in bringing to the realization of the public at large the contribution to society made by doctors, nurses, aviators and others upon whose competence and integrity public safety depends.

Others have squandered thousands and thousands of dollars and much valuable time, throwing a haze of glamour and romance about the men and women of the underworld—until the public became definitely sick and tired of having crime thrown at them every time they went out for an evening's entertainment.

The field of construction, and the part which engineers, contractors and



Williams "DXL" Dragline Bucket
For More Yardage Per Day

Special alloy steel permits lighter yet stronger construction. Rugged reinforcement at points of stress and wear assure long life.

We also build Power-Arm and Multiple-Head "Chisel" Buckets for every purpose. Write for Bulletin.

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their men play in the lives of the public, their contribution to society and progress, has finally come to the fore and "Under Pressure" brings to the public

which sees it an interesting and realistic portrayal of that all-too-long neglected field of human endeavor. At last recognition has come to us!

NOW AVAILABLE in a Complete Line



—These Better Designed Two-Stage Water-Cooled Compressors

Gardner-Denver Class WB Compressors have started something! Throughout the country, buyers are revising their ideas of compressor performance when they learn how much MORE air these compressors deliver—at LESS cost per cubic foot of air delivered.

And now WB Compressors are available in a complete line of three and six cylinder models . . . seven sizes ranging from 113 to 445 cu. ft. per minute displacement.

Mountings include motor mounted on shaft . . . V-belt to electric motor, Diesel and gasoline engines . . . or direct connected through flexible flywheel coupling to motor and engines. A combination radiator with air and water-cooling system inte-

Two-staging means

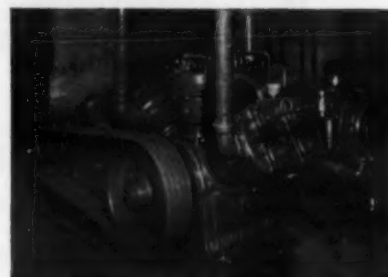
25% more air
drier, cleaner air
less power per foot of air delivered

Water-cooling means

lower cylinder wall temperature
lower discharge temperature
cooler discharge valves
less lubricating oil consumption
absence of cylinder distortion from heat
independence of atmospheric temperature

gral is supplied for installations where running water is not available.

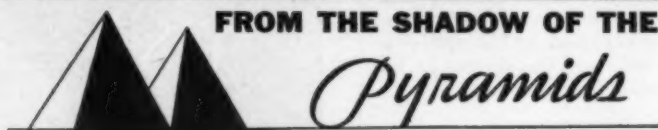
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A Rocky Mountain Installation of a Gardner-Denver WB Compressor

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MAKES AIR DO MORE AND COST LESS



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Culture from all parts of the world assembles in Washington at the Willard. From the peaceful Nile to Alpine torrents, the Willard stands for luxury, exclusiveness, and all the comfort this world has to offer in modern hotel accommodations. Moderate rates make a stay here affordable to the average Washington visitor.

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Egypt established its first American Legation at the Willard in 1927.

Concrete Pumped 750 Feet for Dam

(Continued from page 10)

the fleet averaging about twelve mostly Mack and Sterling trucks.

The rock excavation for the footings was about 2½ feet deep with a 3-foot cut-off trench along the center line of the core wall. The maximum excavation in rock ran 10 to 12 feet and was in the core wall trench. Ingersoll-Rand jack hammers and portable compressors were used for drilling the rock for the regular excavation, and wagon drills for the heavy excavation and grout holes. Air for the wagon drills and other heavy pneumatic operations was supplied by four Ingersoll-Rand 320-foot stationary compressors mounted in a shed about 700 feet south of the dam. Air was piped through a 4-inch diameter line reduced to 2-inch lines for the drills through a manifold.

In the cut-off trench and footing excavation, the shovels and cranes were used for the top lifts and then hand loading of skips and dump buckets handled by the crane. Work was pushed at night on the core wall trench with the area illuminated with General Electric floodlights. When the footings were poured, they were carried a minimum of 18 inches above the original rock.

The largest single volume of excavation was in the waste channel south of the dam. Here 33,000 cubic yards of rock was removed to a depth of 50 feet and in a cut 400 feet long. This unusual volume of excavation for an outlet channel was finally decided upon by the engineers as the most economical method after various other schemes and locations had been estimated.

When the rock excavation was ready for pouring it was first hosed down with a high-pressure stream to clean off any small fragments of loose rock. Then the surface was plastered with grout from ½ to 2 inches thick just before pouring the concrete.

Water from gravel strata in the overburden and from repeated rains made necessary the installation of three 4-inch Domestic centrifugal pumps for unwatering. These were supplemented in isolated sections by a hand diaphragm pump and one power diaphragm pump.

On the backfill, which was kept wet at all times to permit maximum consolidation, 4 feet of loamy soil was first placed in a horizontal stratum on top of the natural ground level upstream and a soil core was placed against the concrete core wall on the upstream side to furnish an impermeable cut-off. The backfill was dumped from the hauling trucks and spread by tractors and bulldozers which assisted in the consolidation of the layers. Soil was spread in 4-inch layers and gravel in 8-inch layers upstream and 12-inch layers downstream. The spreading was done with a Caterpillar diesel Fifty with a La-Plant-Choate bulldozer. Two other Caterpillar Fifties, one a diesel, with bulldozers and a Euclid sheepsfoot roller was used to compact the loam. On the remainder of the fill a Buffalo-Springfield 10-ton gas roller was used. This was equipped with ribs on the front roll. Some of the hauling for borrow was done with fourteen Smith trailer steel dump wagons, a group of Euclid Trac-Truk dump wagons and an Athey truss-wheel wagon.

Grouting

Grout holes for stabilizing the foundation were drilled to depths as great as 25 feet in two lines on 15-foot centers. They were 3 inches diameter at the top and were drilled with Ingersoll-Rand wagon drills. The rock was seamy and occasionally a drill was lost. The grout was placed at 15- to 50-pound pressures with a Ransome pressure

grouting machine. The higher pressures were only needed a few times.

Forms—Wood and Steel

Wood forms were used for the footings because of the irregularity of the rock and were carried to Elev. 10 above which steel forms were used. Vertical joints were placed in the core wall every 30 feet. Water stops, consisting of 8-inch by ¾-inch ingot iron plate, were inserted across the contraction joints. Four tapered grooves 4 inches by 12 inches wide were placed in the end of the construction joints for interlocking and tapered to permit ready pulling of the forms. The wood forms were made up in 4 x 6 panels of 1 x 10-inch lumber with diagonal wire ties to brace the footing forms.

The upper portion of the core wall was built in 10-foot lifts 30 feet long with Blaw-Knox steel forms, using I-beam stretchers punched to give the proper batter. These forms were readily handled by the crane from one lift to the next or to adjacent sections. Blaw-Knox arch forms 17 feet high and

21 feet wide were used for the total 500-foot length of the conduit between the upper and lower gate houses.

General Information on Dam

The Bills Brook Dam on the east branch of the Farmington River will serve as a combined compensating reservoir and water supply project for a number of years. The East Branch Reservoir below the new project compensates for the flow of the Nepaug River, which formerly flowed into the Farmington River and is now used as a part of the Hartford water supply. The Bills Brook Dam is being built to create an additional supply for the Hartford District. The present contract includes the lower portion of the dam to Elev. 460 and this portion of the work will cost about \$540,000. The principal dimensions of the completed dam will be as follows: length, 2,275 feet; maximum height above the stream bed, 137 feet; maximum base width, 900 feet; width at the flow line, 131 feet; freeboard, 15 feet. The maximum section of the core wall is 12 feet thick,

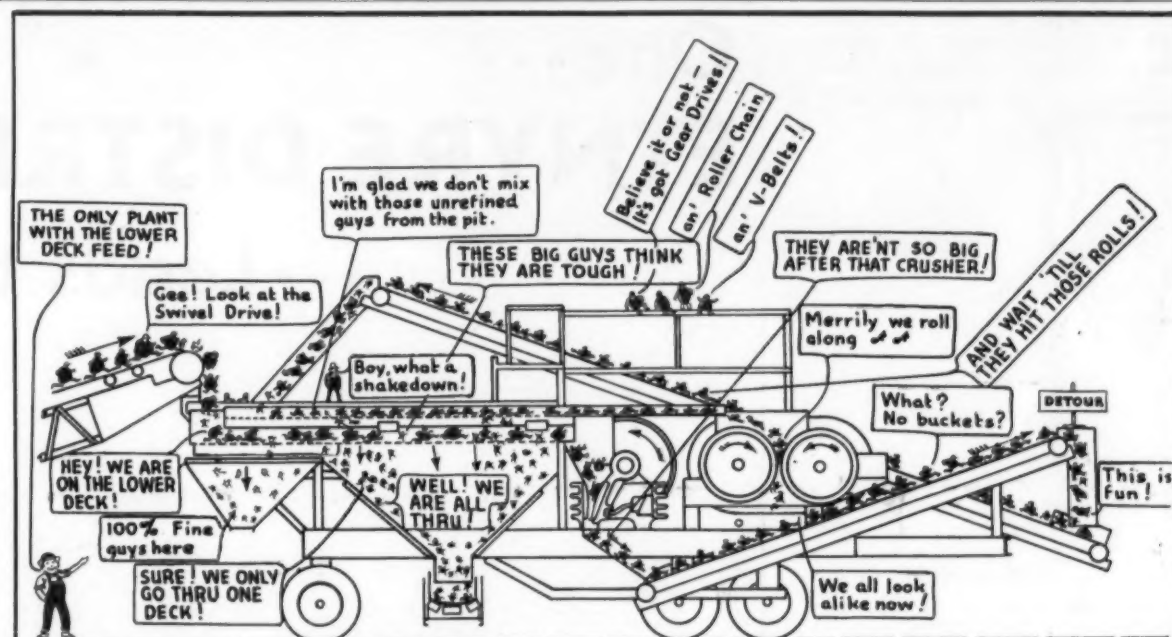


Hauling Earth Excavation with a Pneumatic-Tired Trailer Truck

this section being widened for the footings 3 feet downstream and 8 feet upstream. The core wall is of uniform thickness for the lower 25 feet and then tapers on a 20 to 1 batter on both sides to 2½ feet thick at the top. The height from the bed of the river is 137 feet.

Construction Schedule

The contract for the construction of the dam was awarded on July 24, 1933. Clearing and grubbing started July 27, (Continued on page 29)



NEW PIONEER 15-35 DUPLEX CRUSHING, SCREENING and LOADING PLANT

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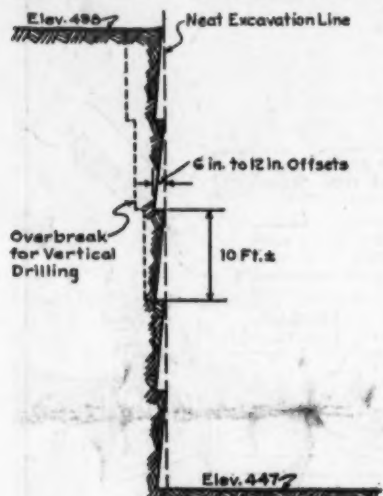
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Quarrying Limestone at Wheeler Dam

AMONG the various methods of drilling and blasting used for the 500,000 cubic yard rock excavation at Wheeler Dam about 15 miles above Wilson Dam on the Tennessee River in Alabama, the method of removing the stratified limestone is most interesting. The main seams, or bedding planes, lie almost exactly horizontal and the limestone is unusually hard. W. M. Hall, Construction Engineer at Wheeler Dam, described the method in detail in a recent issue of *The Explosives Engineer*.

This dam, which was started in November, 1933, when completed will be 50 feet high, approximately 6,000 feet long and will create a reservoir about 100 square miles in area. It is not primarily a storage dam but is chiefly for power generation, as is Wilson Dam below it. The power plant will eventually house eight 35,000-kw generators. In addition, Wheeler Dam will provide a navigable water way nearly the full length of its lake which will extend about 5 miles above Guntersville, Ala.



Wagon Drills Were Set at a Slight Inclination to Reduce Overbreak

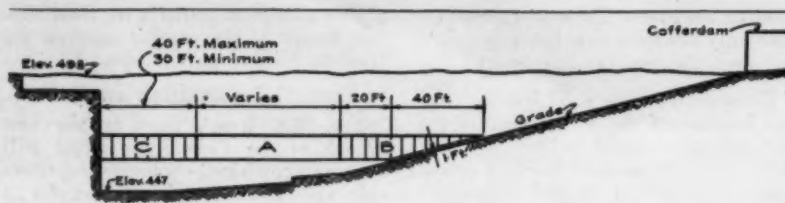
Drilling

The rock is removed from the excavation in layers, each about 10 feet deep. A typical layer, lettered A, B, and C, is shown in an accompanying vertical cross-section of the power house, draft tube, and tailrace excavation. The letters indicate the order in which separate portions of this layer are taken out. That marked A is removed first, and is the most economical method from the viewpoint of speed and cost, as it is far enough from the walls of the cut so that blasting will not endanger their solidity. The portions marked B and C are drilled and blasted out in strips, each strip shown representing one line of drill holes.

The upstream face of this section has a vertical neat excavation line about 50 feet high. This wall, like all others of any considerable height, was line drilled, primarily to avoid any unnecessary disturbance to the rock wall, but also to prevent overbreakage and the consequent additional rock handling and concrete costs.

Because of the height of this wall, the drills were inclined slightly from the vertical in such a way that each new setting of the drills on successively lower lifts could be directly under those above. An enlarged section of this wall indicates the method, and the volume of additional excavation that would have been necessary with vertical drilling. Actually very little rock has been removed outside the neat line of excavation. The wagon drills used for this work had their wheels removed and were set upon steel rails.

The line drilling, outlining the excavation, has been done with holes spaced 4 to 5 inches center to center.



Vertical Transverse Section Showing Downstream Cofferdam at Right. Depth of Horizontal Cuts Were Varied to Suit Bedding Planes. Holes in Section B Were Stopped 1 Foot from Bottom Excavation Line to Avoid Shattering Rock Below.

Elsewhere drill holes have been spaced 5 to 6 feet apart in both directions. The linear footage of line drilling in this section of the dam has slightly exceeded the drill footage on regular blasting work. The explosive used has been almost wholly dynamite of 40 per cent strength, and somewhat over 125,000 pounds will be used in this part of the work. Wherever it has been possible because of safe distance from the walls, sufficient explosive has been used in the primary blasting to break the rock to

an economical shovel size and avoid blockholing.

The drill equipment consists of 13 wagon drills, using 1¼-inch hollow steel. These are supplemented by 5 to 10 jack hammer drills fitted for ¾-inch hexagon drill steel. Compressed air is furnished by two compressors driven by 400-hp electric motors.

Loading and Hauling

Loading is done by two electric power shovels with 2½-cubic yard dippers.

Rock is hauled to the dump by seven 10-yard dump trucks. Particular attention has been paid to maintaining truck roads and dump areas, as well as to the floors over which the shovels must travel so that all equipment can move with a minimum of difficulty. The maximum grade of truck roads coming out of the lower level of excavation is 8 per cent. A crawler-mounted bulldozer is used on the rock disposal dump to push the rock over the bank quickly and keep the dump area level.

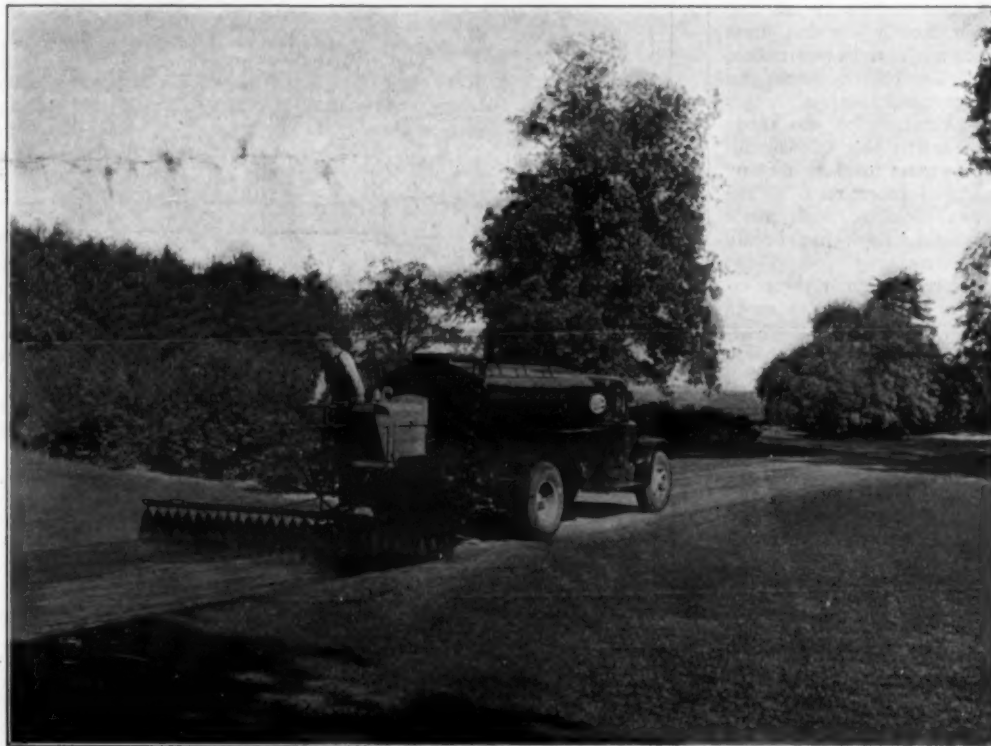
Construction work on the Wheeler dam is under the direct supervision of Lee H. Huntley, Superintendent of Construction.

Recently a combination of accumulated rubbish, welding sparks, and a night watchman who didn't watch resulted in a construction fire loss of several hundred thousand dollars. Watch the winter job even more carefully than summer construction.

One ---

ETNYRE DISTRIBUTOR

--- Leads to Another



This is an 850-gallon ETNYRE Model MO2C distributor spraying a 14-foot driveway. Circulating spray bar with instantaneous shutoff at nozzles can be furnished up to 24 feet in width.

ETNYRE engineering principles and manufacturing methods are concentrated in producing a distributor that gives ACCURATE APPLICATION of all bituminous materials.

May we suggest that you ask any Etnyre owner his experience before ordering your next distributor.

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E. D. ETNYRE & COMPANY

DEALERS IN ALL PRINCIPAL CITIES

400 JEFFERSON ST.,

OREGON, ILL.

Another Dirt Mover Halts Old Man River

(Continued from page 5)

by the 2-yard 45-B and 3-yard 52-B Bucyrus-Erie draglines. The 10-yard car on the bridge runs under the hopper, is automatically loaded, and then runs to the other end of the bridge where its load is dumped into the levee. The car is at all times under the direct control of the operator who is so placed in the tower of the A-frame, with his controls, as to command a clear view of all operations. The car is dumped by an electric solenoid operated by a control switch at the operator's position and so arranged that it cannot be dumped on the loading side of the machine. Another safety device is an indicator, in front of the operator, which shows at all times the exact location of the car. This has been found of great value when fogs obscure the ends of the machine.

Moving the Bridge

The bridge works on mats which have been developed especially for this job. They are 9 inches thick by 8 inches wide and 14 to 16 feet long, made up of 3 x 8-inch oak planks nailed together. One of the Allis-Chalmers tractors with a bulldozer is used for a few hours to move these mats into tracking position and is then available the rest of the day for dressing levee, preparing or tracking right-of-way and any other job that may come up. The bridge has successfully negotiated extremely soft wet ground, and slopes of approximately 7 per cent. Moving the bridge from one working position to the next on levee work generally requires from three to four minutes.

Varied Operations on New Levee and Enlargement

On levee enlargement the bridge with its attending draglines builds the entire section as it progresses. New levee must be built in two runs. The bridge builds the landside slope first with material taken from the inside portion of the borrow pit. The second run completes the levee as the bridge brings in material from the far end of the pit, with the loading end of the bridge spanning the excavated portion of the pit.

The output and operation of the bridge and dragline combination compares favorably with other types of equipment of its size and capacity. The machine on this work has been capable of transporting all the material either the two small draglines or the 6-yard dragline were able to feed it without delay to them. The machine will haul approximately 9 cubic yards gross on cycles averaging 50 seconds. Cycles have been made in 42 seconds. The peak production, so far measured on this job, has been 7,840 yards of material placed in the levee in 24 hours.

Diesel Power and Labor Organization

Power for all the operations of the bridge is obtained from a 6-cylinder 150-hp Worthington diesel engine, requiring approximately 100 to 120 gallons of fuel per 24 hours. Various clutches at the operator's position control the operation of the car, movement of the entire machine, and the raising and lowering of each end of the bridge. A 7½-kw Westinghouse generator supplies electric current for the lights and for the operation of the solenoid car dump.

The crew necessary to operate the bridge consists of one foreman, and for each shift, one operator, one oiler, one trackman and one hopperman. One spotter or flagman is used on the dump to direct the placing of the dirt. Three shifts are used, each working 8 hours.

A more detailed article on the Chambers Bridge, with particular reference to loading and unloading the bridge when it was transported by barge, appeared in the November issue of the *Excavating Engineer*, which very kindly furnished the illustration for this article.

Phoenix Distributor Returns to Active Duty

Rockwell O. Egeland, founder and manager of Mine & Smelter Equipment Co., Phoenix, Ariz., has returned to active duty after an absence of almost a year because of sickness and bereavement in the family. He anticipates a very active coming year and improved business conditions, and has made changes in the organization which will enable it to give expert service in the various lines of construction and mining machinery which it has handled continuously for the past fifteen years.

W. C. Jewell, who has many years of accounting and management experience,

has been appointed Office Manager. His familiarity with the steel industry and

its allied lines will be a valuable asset in his new work.

ADJUSTABLE 9' to 15'
Smooth as Concrete - No Forms
JAEGER Bituminous PAVER

- 18' Long Straight Edge Runners, full floating, equalize subgrade.
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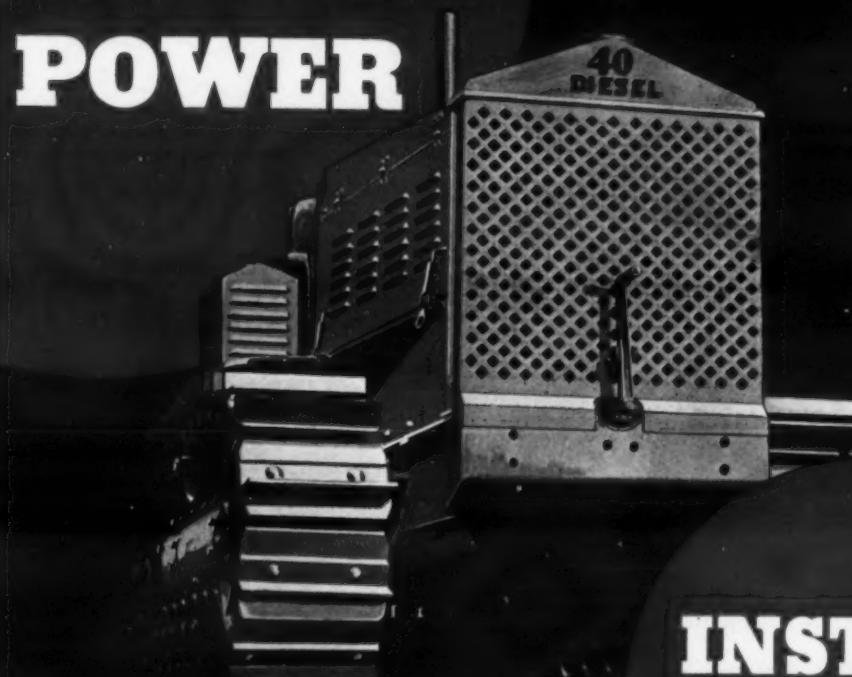


Paver Pushes the Discharging Truck

15 FT. LANES MEANS 50% MORE TONNAGE, ONLY ONE JOINT TO FINISH

18' STRAIGHT-EDGE RUNNERS EQUALIZE SUBGRADE—ALL TRACTION ON HARD SURFACE—ONLY SCREED AND BLENDEES TOUCH NEW MATERIAL

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New Cletrac 40 simplifies Diesel tractor operation...



A smooth flow of power...available at the turn of a switch. Starting the Cletrac 40 Diesel is as simple as starting an automobile, and once started the six cylinder engine delivers plenty of steady, dependable power to handle those big jobs. This new Cletrac will pay its way on your jobs in increased working time and lower operating costs. Write for complete information. » » »
THE CLEVELAND TRACTOR CO., Cleveland, Ohio

CLETRAC CRAWLER TRACTORS

1,100-Ton Concrete Pier Removed by Big Blast

The methods employed to remove a center pier at Sea Isle City, N. J., by the Pennsylvania Railroad contains suggestions valuable to every contractor who may face a problem of this kind. The center or main pier was the first one to be blasted. It was octagonal in shape, 22 feet in diameter, and about 30 feet deep. Twenty-five holes were drilled vertically with a wagon drill to a depth of 30 feet, and eight to a depth of 14 feet. These holes were spaced equally throughout the concrete mass with one 30-foot hole in the exact center. The weight of this pier was approximately 1,100 tons.

About 500 pounds of du Pont dynamite was used in the loading of the 33 holes. Two hundred pounds of special gelatin 60 per cent was loaded in the bottom of the holes, 200 pounds of special gelatin 40 per cent was loaded next, and then 100 pounds of Red Cross Extra 40 per cent was used in staggered charges for the breaking of the top. It was necessary and compulsory to blast and break this pier completely to a depth that would insure the easy removal of the broken concrete so as to obtain a depth of 20 feet below mean high tide, or equivalent to the channel depth. As there was approximately 6 feet of this pier extending above high tide, this meant breaking the concrete practically to the bottom of the 30-foot holes.

Broken Pier Not Scattered

The shot was remarkable because the material was not thrown; it rose vertically and spread out about 40 feet in each direction. The main highway was about 900 feet distant from this pier and a fisherman's house about 75 feet away. Not a shingle or a pane of glass was disturbed, nor was there any damage from vibration. The blast was successful in every way, and the two remaining piers were then loaded similarly and they also blasted perfectly.

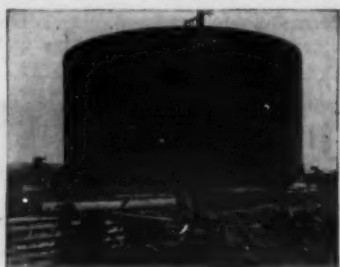
Pneumatic Impact Wrench Tightens or Loosens Nut

A 20-pound machine that spins a 1-inch or larger nut at 700 rpm and then gives it a series of smart torsional blows at the rate of 1,400 a minute to tighten it, has been announced by Ingersoll-Rand Co., 11 Broadway, New York City. This Ingersoll-Rand Pott impact wrench has a rubber "accumulator" which is a cylindrical block of special rubber interposed between the air motor and the chuck. The torque from the motor is applied to the accumulator which in twisting becomes shortened, lifting the hammer from engagement with the anvil. The hammer is then released and is spun forward to the next engagement, thus delivering a powerful blow with considerable mass behind it.

One man operates the wrench easily as the accumulator absorbs the torque and eliminates the danger of shock or injury to the operator. This wrench has a wide field of application in structural steel work and wherever considerable nut running, whether applying or removing, is done.

10,000 Barrel Tank Raised Intact 14 Feet

The unusual feat of raising a 100-ton tank vertically 14 feet from ground level to an elevated railroad right-of-way and then moving the unit 500 yards was recently accomplished in Chicago, Ill. The 3-year old cone-roof, bolted and welded tank, 52 feet 6 inches by 27 feet 3 inches, was sold by the Hughes Oil Co. to the Seneca Petroleum Co. The tank contains eight compartments, one circular and seven radials, each equip-



Landing the 10,000-Barrel Tank on the 14-foot Fill

ped with steam coils which were left intact.

The usual procedure is to cut a large tank apart to move it but in this instance, because of the solid construction, it was not deemed necessary. The tank was built by the Graver Tank & Mfg. Corp., East Chicago, Ind., and was moved by Wm. H. Brown & Co., Chicago.

Owners of Motor Vehicles Paid Billion-Dollar Tax

In the broadest survey yet attempted, tax payments by owners of the various classes of motor vehicles in 1932 have been determined by the U. S. Bureau of Public Roads. The survey shows that the owners of 24,619,602 motor vehicles paid an approximate total of \$1,001,150,000 of which \$838,830,978 was from State fees and taxes and the remainder from Federal, county, municipal and personal property taxes, and bridge and ferry tolls.

In addition to the State fees and taxes the amounts paid were:

Federal manufacturers' excise taxes.....	\$92,378,000
County fees and taxes, incomplete.....	1,703,000
Municipal fees and taxes, incomplete.....	14,158,000
Personal property taxes, all jurisdictions, approximate	35,880,000
Public bridge and ferry tolls, incomplete.....	18,200,000

Only the public charges borne directly by the motor vehicle owner were in-

cluded in the survey totals. Purposely excluded from the investigation were such indirect charges as automobile dealer licenses, fines and penalties, real-property taxes on automotive property including factories, garages, terminals, etc., income taxes on motor vehicle operating enterprises, state chain-store and retail-sales taxes on gasoline and automotive dealers, and similar imposts not levied directly on motor vehicles.

Equipment Accounts Wanted

R. G. Moeller Co., distributor of industrial and construction equipment, 14415 Meyers Road, Detroit, Mich., writes that arrangements have been made to add a few more meritorious industrial and construction items to their 1935 sales program and will be pleased to discuss such accounts with manufacturers seeking distribution in the Detroit territory.

ON Any job

THESE ARE THE COSTS YOU ARE MOST INTERESTED IN:

- 1 ✓ LOW FUEL COST
- 2 ✓ LOWER ORIGINAL COST
- 3 ✓ LOWER MAINTENANCE
- 4 ✓ LESS DEPRECIATION

BUY THE TRACTOR THAT GIVES YOU



10 cents an hour cents
... typical fuel cost A-C
doing the job is you want
running ... time cost wh
tractor when they finish
Tractors do the job Lower

Timber Connector Goes Big in Europe Slow in U.S. Where Born

The timber connector, an American idea rejected at home, has brought a virtual revolution in heavy construction in Europe, according to Peter T. Landsem, formerly Assistant Construction Engineer, U. S. Department of Commerce, and now with the engineering staff of the National Lumber Manufacturers Association. Mr. Landsem has just returned from a year of engineering investigation in Europe. The basic idea of the connector was patented in the United States in 1889. Never utilized in this country, the idea underwent a slow development in Europe and in recent years has become generally applied in heavy construction throughout the continent, notably in the Scandinavian peninsula to simplify the erection

of wooden radio towers, lookout towers, docks, bridges, warehouses, and for roof trusses on structures which require wide expanses of floor space unencumbered with columns. Outstanding examples of the latter are found in steel rolling mills, the builders of which have been enabled, with the aid of these connectors, to build their roof trusses of wood cheaper than would be possible through the use of their own products. Radio towers include the famous structure at Meuhlaker, Germany, a veritable network of wooden timbers which reaches into the clouds 625 feet and supports at the top an antenna ring 10 feet in diameter weighing 1,320 pounds.

Types of Connectors

Types of connectors now commercially available in this country include the split-ring type, which is inserted in a circular groove surrounding the bolt hole, and the alligator type, which is



Pay Day at Berdoo Camp

forced into the wood as the tightening of the bolt draws the two pieces together. The strengthening of a joint attained by placing the connector around a bolt is comparable to the difference in a handshake in which all of the fingers are clasped as opposed to one in which only the thumbs are entwined. The joint itself is made as strong as the strength of the component members.

Where the Money Goes

(Continued from page 1)

The item of Incidental Equipment includes backfilling machines, cableways, derricks, hoists, fire fighting apparatus, motor-generators, refrigerating plants, road building equipment, trenching machines, and miscellaneous items. The States which have benefited from these enormous purchases are

California	\$ 1,750,000
Illinois	2,390,000
Indiana	650,000
Michigan	1,720,000
New York	1,020,000
Ohio	2,210,000
Pennsylvania	1,380,000
Minnesota	125,000
Wisconsin	2,170,000
New Jersey	590,000
Iowa	210,000
Missouri	160,000
Connecticut	105,000
Colorado	70,000
Massachusetts	
Vermont	
New Hampshire	
Georgia	
Kentucky	
Tennessee	
Arkansas	
Louisiana	
Maryland	
Virginia	
West Virginia	
Oklahoma	
Texas	
Kansas	
Utah	
Idaho	
Washington	
Oregon	

Fifteen states benefited from \$70,000 to \$2,390,000, while eighteen other States collectively received orders to a total of \$1,000,000.

How Wages Are Spent

Labor is naturally one of the big construction costs. When analyzed from a purely selfish point of view, we must understand that 29 per cent of every dollar paid to a California workman on this project finds its way directly outside of the State of California. This does not include money sent by any of these workmen to their families in the East. Of the total amount of \$90,517,000 to be expended for labor which remains in the State of California, \$26,250,000 must be sent outside the State to provide for the living requirements of the workmen and their families. Distributed among various States the benefits are as follows:

Annual Expenditures Of an Aqueduct Workman

Wages Spent for	In California	In Other States
Food	\$ 242.00	\$ 39.00
Clothing	43.00	81.00
Housing, fuel and light	45.00	.00
Furniture and furnishings	42.00	47.00
Transportation, etc.	199.00	165.00
Medical care	50.00	.00
Barber services	12.00	.00
Confectionery	6.00	2.00
Drugs and toilet articles	7.00	7.00
Gifts and dues	25.00	9.00
Insurance	.00	59.00
Reading Material	11.00	11.00
Recreation	24.00	.00
Telephone	9.00	9.00
Tobacco	.00	24.00
GRAND TOTAL	\$1,104.00	\$453.00

This does not take into consideration that for each workman employed on the Los Angeles-Colorado River Aqueduct, two workmen are required to produce the equipment, materials and supplies needed to keep that one workman on the job. It was first estimated that 48,000 workmen would be employed as the result of this project. This estimate has been exceeded by those directly employed, not counting those whose indirect employment has come from the work of building Hoover Dam, the aqueduct, the transmission lines and the expansion within the Metropolitan limits of Los Angeles.

The total estimated cost of this project is \$209,420,000. That the entire United States will benefit from its construction is shown by the following figures:

Items of Cost	Spent in California	In Other States
Labor	\$ 90,517,000	\$ 4,522,000
Equipment, materials, supplies	21,015,000	56,345,000
Other costs, including bonds, insurance, etc.	2,835,000	18,566,000

and the following shows the classification of materials and supplies and ex-
(Continued on page 25)



YOU THE LOWEST FINAL COST!

our cents an hour ... 24 cents an hour ... \$1.96 a day
for A-C Oil Tractors. Don't be misled. Final cost of
s you want to know ... repair costs to keep the tractor
ne best when the tractor is down ... condition of the
ches finished. A-C Oil
job Lowest Final Cost.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

MODEL "K-O" ... 48 H.P.
MODEL "L-O" ... 76 H.P.

**THE ONLY TRUCK
AT ANY PRICE THAT
GIVES YOU ALL THESE
FEATURES**

New Cab

Welded all-steel construction. Real passenger-car comfort for the driver. Adjustable driver's seat. Passenger-car-type instruments grouped directly in front of the driver. Safety Glass, standard equipment throughout. Triple ventilation includes: (1) Clear-Vision Ventilation in door windows; (2) easy-opening windshield; (3) large screened cowl ventilator. Seat width increased to 49 inches. Interior of cab completely lined.

New Brakes

Cast alloy iron drums with integral cooling ribs. Drums will not "bell-mouth." No "fading," even when making a series of quick stops in rapid succession. New brake mechanism makes stopping quicker and smoother with heavy loads. Longer life between adjustments.

New Clutch

New design assures much longer clutch life, minimizes slippage and permits smoother engagement. Lower pedal pressure at idling speed. Plate pressure increases as speed of engine increases. Improved ventilation makes clutch run cooler. Diameter increased to 11 inches. Larger frictional area.

Improved Cooling

Larger water pump impellers. Six-blade 15½-inch fan. Wider radiator, 15% more radiating area.

**New Crankcase
Ventilation System**

Directed-flow crankcase ventilation reduces corrosion and oil dilution by removing fumes.

**V-8 Performance with
4-cylinder Service**

The Ford V-8 Truck engine develops more than 80 horsepower. Uses no more fuel than a "four." Dual carburetor and dual intake manifold. Light-weight, cast alloy pistons. Exhaust valve seat inserts. Heavy-duty copper-lead connecting-rod bearings.

Low-cost Engine Exchange Plan... Full-floating Rear Axle with Straddle-mounted Driving Pinion... Full Torque-tube Drive Permits Free-shackling of Semi-elliptic Rear Springs... Deep, Rugged Frame with no "Kick-up"... Oilless Front Spring Shackles... Baked Enamel Finish... Deep-skirted Fenders Match Colors of Hood and Cab.

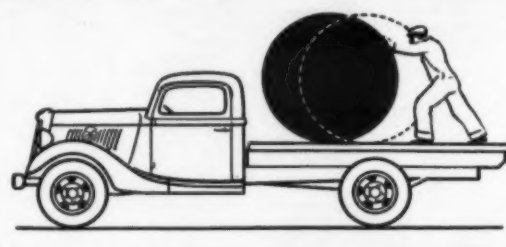
THE NEW 1935 FORD V-8 TRUCK



One hundred and twenty-five thousand Ford V-8 Trucks in use throughout the world have proved their right to the claim "America's great truck value." Because of this widespread acceptance, the entire production of Ford Truck engines is of the V-8 type.

To the proved design of the Ford V-8 Truck have been added many new features. But from your point of view, the most important question is: "What will this new truck do for me?" Your Ford dealer is ready to answer that question right NOW. He is so proud of this new truck... he is so confident of V-8 performance and V-8 economy that he will gladly arrange an "on-the-job" test for you if you are in the market for a new truck. Ask your Ford dealer to let you try a 1935 Ford V-8 Truck with your own loads... over your own routes... with your own driver at the wheel.

Then ask the price! Such performance and economy at a price so low will convince you once and for all that this 1935 Ford V-8 Truck is now more than ever AMERICA'S GREAT TRUCK VALUE!



The front spring and engine have been moved forward on the chassis, thus making it possible to move the body and load-center further forward. The distance from back of cab to center of rear axle is increased 8½ inches. This results in more efficient braking and more uniform tire and brake wear.

PRICES

TRUCKS		157-inch Platform . . . \$690
131½-inch Chassis . .	\$500	157-inch Stake 735
131½-inch Chassis with Closed Cab . .	595	
131½-inch Platform . .	650	
131½-inch Stake . . .	675	
131½-inch Panel	760	
131½-inch Dump Chassis	530	
131½-in. Dump Chas- sis with Closed Cab	625	
131½-in. Dump Truck	800	
157-inch Chassis . . .	525	
157-inch Chassis with Closed Cab	620	

COMMERCIAL CARS	
112-inch Closed Cab and Chassis	\$435
Drive-away Chassis .	360
112-in. Panel Delivery	565
112-inch De Luxe Panel Delivery . . .	580
112-in. Sedan Delivery	585
112-in. Station Wagon	670
112-inch Pick-Up . . .	480

(All prices f. o. b. Detroit. Con-
venient terms through facilities
of Universal Credit Co.)

ALSO A NEW LINE OF SMART, FAST FORD V-8 COMMERCIAL CARS

Contractor's Sample Brought Big Contract

(Continued from page 9)

forcement was $\frac{3}{4}$ -inch round bars around the edge of each slab and $\frac{1}{2}$ -inch round bars spaced 36 inches longitudinally and 30 inches transversely.

For the 30-foot pavement, one longitudinal joint was used, on the center line. On the 50-foot streets, three longitudinal joints were installed. Tie bars, spaced 3 feet apart, were used across these longitudinal joints.

Longitudinal joints at the center line were made by putting beading on wooden forms to make a groove in the slab built first, for a tongue and groove joint. The slab was built half at a time.

Some of the streets had sandstone curbs and these were removed and replaced with concrete curb that was monolithic with the resurfacing. At such places, the edge of the old base was broken off to allow the curb to extend to 3 inches below the base.

Some Unusual Methods

Some unusual construction methods had to be adopted. It was impossible to drive stakes through the base, so holes were drilled at 3 or 4-foot intervals with an air hammer, through which 2 x 2-inch wooden stakes were driven to hold the form in place on the center line. When the form was removed, these stakes were cut off flush with the base, with a mattock.

The slab was struck off with hand screeds that rested on the forms at the center. At the edge, where the old straight curb was left in place, a guide for the screed was made by drilling holes through the base and driving in them a line of wooden pegs. The pegs were driven to grade, by level, and a plank was placed across them on which the end of the screed rested.

In one section, a water trench had been dug longitudinally and the old pavement had been patched with concrete that came flush with the wood blocks. This concrete was removed with a power shovel and a new base was put in before the resurfacing was laid.

Throughout the city, street cars have been supplanted by busses and the street railway tracks are abandoned. Old tracks were therefore removed on the resurfaced streets and new base was laid over the car track area, to be topped later with the concrete resurfacing.

A 105-Square-Yard Sample Grew to 65,000

The first contracts totaled 30,578 square yards of which the city's portion was 9,250 square yards. An additional 17,412 square yards of resurfacing has been contracted for and plans are being prepared for 17,700 square yards more, making a total of 65,000 square yards of resurfacing as the outgrowth of the 105 square yards of experimental work.



Reinforcing for Resurfacing Showing in Background the Guide for the Screed, Set by Level.

Mexican War Causeway Uncovered by Hurricane

A United Press dispatch from Austin, Texas, brings the news that Texas highway engineers have discovered some of the causeway built by General Zachary Taylor's forces during the Mexican War. The causeway across Boca Chica at the extreme southwest limit of the United

States has been buried in sand and water for years. A recent gulf hurricane changed the water line, and brought the old military causeway to view.

It was built upon piles and most of the posts were cypress. The good condition of the cypress posts after years caused little surprise, but the engineers were astounded to find that the trunks of palm trees had also been used and also were in a good state of preservation.

A Dam Around the World

It is estimated that the concrete which will go into High Dam, the ultimate unit at Grand Coulee, the Federal project on the Columbia River, Wash., would make a strip of concrete a foot thick and a foot wide twice around the equator. It would make a concrete shaft 100 feet square and 48 miles high.

PROGRESS

We have introduced:

The wide screed; Forward and backward screeding; Starter springs for screeds; Finishing machines for roads up to 50 feet; Three to four-foot finishing machine complete.

The wide screed prevents matrix from passing underneath. The three, four and five-lane finishing machine speeds up the work. One contractor finished a four-lane road (seven months' job) in three months.

Equipment furnished by

FLEXIBLE ROAD JOINT MACHINE COMPANY . . . WARREN, OHIO

CALL FOR A SHOW-DOWN

Ask for the "Caterpillar" Show-Down—a demonstration of Diesel power and economy on your own job doing your work. See for yourself—and check performance with operation records of "Caterpillar" Diesel Tractors and Engines that have been giving faithful, trouble-free service for thousands of hours on scores of different power tasks. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.



USE RIGHT BUCKET FOR THE JOB



Hayward makes all four—clam shell, drag-line, electric motor, orange peel. A Hayward recommendation is unprejudiced.



THE HAYWARD CO., 32-34 Day St., New York

HAYWARD BUCKETS

Arc-Welded Siphons on Owyhee River Line

(Photo on page 40)

Two huge siphons, one 10 feet 6 inches and the other 9 feet in diameter, constructed by arc welding, are part of the North Canal in the Mitchell Butte diversion of the Bureau of Reclamation Owyhee River project in eastern Oregon.

The first pipe to be installed in the Owyhee Canyon was 700 feet in length, 9-foot diameter pipe fabricated from 3/16-inch steel plate. This pipe was placed in a trench 29 feet deep and then completely encased in concrete.

After the lower section was welded in place, heavy test heads were welded on each end and the line tested to 200 pounds for a period of 12 hours. Following this test, the same pressure as that effective when the siphon is placed in use was held in the line during the time the concrete was being poured and for ten days afterwards, making a total test period of approximately 30 days. There were no leaks in the field welding of this section. The field joints on the encased portion of the Owyhee siphon were butt vee type with no backing up strap, while the joint on the exposed section were butt vees with an outside butt strap 3/8-inch thick.

Heat Causes Difficulty

High mid-day temperatures, 125 degrees in the shade, caused some difficulty in fitting the joints. In the case of the flat river section, after the string became more than 200 feet in length, it was found that the top of the pipe had a tendency to become longer than the bottom. A method was devised whereby the tops of the sections were secured by tack welding and the bottoms by pull jacks, leaving a gap at the bottom sometimes as much as 1/4-inch greater than the top gap. The following morning when the temperature equalized, no trouble was experienced in bringing the pipe flush and then tack welding.

The welding was accompanied by a thorough peening with pneumatic tools. Skilled pipe welders were qualified by test. Two-thirds of the joints required staging inside and out due to the steep grades. A total of 13 passes and 41 hours was required for each 13/16-inch butt vee joint.

Personnel

A crew of approximately twenty-five men and four arc welding machines handled the placing of the pipe and the field welding on the two sections of this work. Olson Manufacturing Co. of Boise, Idaho placed and welded the pipe under the supervision of Hanford Haynes, Superintendent. Two sizes of electrodes, 5/32- and 3/16-inch, were specified by the Bureau of Reclamation and were furnished by the Lincoln Electric Co. The pipe was furnished by the Chicago Bridge & Iron Works.

"The Strongest Geared Power for Its Weight in the World"—

BEEBE ALL-STEEL HAND HOIST

Capacity—5 tons straight line
Weight—110 pounds
Size—16x17x13" high
Two speeds—4 to 1; 24 to 1
Positive internal brake
Price \$75. Write for list of dealers

BEEBE BROS.

2734 Sixth Ave.,
South
SEATTLE,
WASH.



A Close View of the Expansion Joints and Anchors of One of the Siphons.

New 6-Cylinder Engine Develops 83.8 Horsepower

The biggest of the JX series of Hercules 6-cylinder gasoline engines has been announced by the Hercules Motors Corp., Canton, Ohio. It has a 320-cubic inch displacement, developing 83.8 hp at 2,800 rpm and 65.5 hp at 1,800 rpm with a maximum torque of 204 foot pounds at 1,000 rpm. The 2 1/2-inch chrome molybdenum crankshaft is supported by seven bearings of the high lead bronze precision type. The cylinder and crankcase are cast integral of molybdenum alloy iron and the cylinder is of L-head design, detachable, and fitted with exhaust valves of 1 3/8-inch clear diameter and inlet valves 1 1/2-inch clear diameter.

Lubrication is by forced feed through a gear pump to all connecting rod and main bearings and the oil thrown off from the rods lubricates the cylinder walls. The aluminum alloy pistons are fitted with four rings, all above the piston pins, an oil control ring 3/16-inch wide and three compression rings 1/8-inch wide.

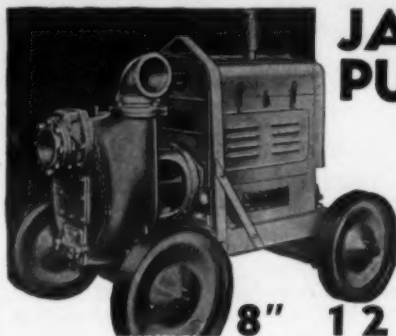
This JXD engine and the other three of the same series, JXA developing 63 hp, JXB developing 68 hp and JXC developing 73 hp, all at 2,800 rpm, are identical in installation measurements and are also supplied as power units of the open or fully-enclosed type.

New Surface Treatment for Concrete Floors

A surface hardening treatment for concrete floors, which not only penetrates the floor surface to weld the cement and aggregate into a solid mass, but is also claimed to act as a vehicle for a solid that fills and seals the surface pores, eliminating the pockets that hold

disintegration agents, has recently been announced by Stonhard Co., 401 N. Broad St., Philadelphia, Pa.

An abrasive test on floors which have received the Stonhard concrete surface treatment gives evidence that a floor so treated will withstand wear 162.5 per cent better than an untreated floor, and the treatment can be applied on floor areas without interrupting production.



JAEGER Automatic PUMPS

- Prime Faster
- Pump More Water
- Pump More Hours

2", 3", 4", 6", 8" sizes. Capacities 10,000 to 125,000 g.p.h.

Our catalog P-34 gives full details. Write for it.

THE JAEGER MACHINE CO.
701 Dublin Ave., Columbus, Ohio

8" 125,000 G. P. H.

for
service

and
long life—



Responsible
for more miles
of Durable Pavement
Than Can Be Credited to
All Other Makes Combined

Built in complete range of
models in both three-wheel
and tandem types. Full as-
sortment of attachments.

Write:-
The Buffalo-Springfield
Roller Company
Springfield Ohio

LE TOURNEAU

Carryall Scrapers
move...

**65 YARDS AN HOUR
OVER A 3100 FOOT ROUND
TRIP HAUL!**

Winter working conditions in New England too. Here are dirt moving machines that defy traditional delays and bad working conditions. THEY MOVE MORE YARDAGE—CHEAPER.



R. G. Le Tourneau, Inc.

Let us help YOU with YOUR dirt moving problems. Just drop a note to our Engineering Department.

Factory, Stockton, California.

Branch, Peoria, Ill.

Where the Money Goes

(Continued from page 21)

penditures both in California and in other States:

Construction Materials	California	Other States
Construction equipment.....	\$ 1,750,000	\$13,000,000
Steel products	4,177,000	10,593,000
Cement	6,900,000	2,800,000
Electric machinery.....	500,000	5,300,000
Explosives	1,520,000	5,380,000
Hydraulic machinery.....	60,000	5,990,000
Copper products.....	150,000	2,150,000
Lumber	100,000	990,000
Lead oil	120,000	30,000
Small tools and supplies..	1,020,000	3,600,000
Transportation (Freight) ..	3,620,000	9,750,000
Electric power	1,098,000	862,000

The steel products required for this project involve an expenditure of \$14,770,000. The analysis of this item illustrates how many states other than California are receiving a direct benefit from these purchases. Under this heading we find a purchase of reinforcing steel amounting to \$3,640,000; steel pipe, \$377,000; steel rails, \$372,000; plates and shapes, \$7,289,000; tunnel supports, \$750,000; transmission towers, \$975,000; structural shapes, \$243,000; and miscellaneous steels, \$1,124,000. Again, let us examine which states receive the benefit of these purchases: California, \$4,177,000; New York, \$430,950; Pennsylvania, \$3,761,000; Ohio, \$3,262,400; Indiana, \$1,048,000; Illinois, \$837,750; Utah, \$401,500; and all others \$851,400.



Steel Tunnel Lining in One of the Water Tunnels—A Job Which Has Given Work to Many

Raw materials entering into the fabrication of these finished steel products involves iron ore amounting to \$1,025,000; iron and steel scrap, \$1,305,000; coke, \$324,000; and limestone, etc., \$69,000. Seventeen states supply the raw materials to produce the steel products for this one project. A total of 264,000 tons of finished steel is the net result that will find its way into some part of the Los Angeles-Colorado River Aqueduct.

Other Manufactured Goods

California, because of its numerous cement mills, will furnish the bulk of the cement used in the 5,000,000 cubic yards of concrete. However, the gypsum used comes from Nevada, and the packing materials come from Arkansas and North Carolina. The total of \$5,800,000 worth of electrical machinery benefits twenty-four states through its purchase. Ten states are benefited by the purchase of finished hydraulic machinery, and ten other States by supplying the raw products entering into the manufacture of this machinery. Sixty-nine per cent of all money spent for explosives goes to industries outside the State of California. This is divided among sixteen states. Thirteen states are supplying the finished copper products; eleven states furnish semi-manufactured copper, and six states furnish the raw copper. Twenty-one states derive the principal benefits from this

item of purchase.

The Freight Bill

In conclusion of this analysis, 1,200,000,000 ton-miles of railway freight will be involved in transportation of finished products and equipment for the Aqueduct. This involves most of the leading railroads of the United States.

Highlights of "Open House" at Allis-Chalmers Plant

Displaying a highly diversified line of equipment, Allis-Chalmers Mfg. Co., was host on January 19 at an "open house" to more than 30,000 interested guests. The chief attraction was the huge hydraulic turbines for Hoover Dam, but there were many other products, numbering into the hundreds, on display by the eight major departments of the company.

The tour began at the South Tractor Office Building and continued through the plant, including the tractor show rooms, main office building, pattern shop, foundry, machine shop and an exhibit of its small industrial products.

Among the unusual equipment used at the plant, which was on display to the guests, is a periscope, similar to those used in the World War, for examining the interior of forgings to discover defects in the metal. Another is the largest boring mill in America, on which castings and parts up to 40 feet 4 inches in diameter and 16 feet in height are bored and turned.

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., which was organized in 1901, manufactures a wide range of construction and road building and maintenance equipment, as well as many other products in allied fields.

Boy Hits Dynamite Cap; Dead, Four Hurt

That headline is altogether too common in the daily press. The year 1933 showed an increase of 15 per cent over this type of accident in 1932. The first eight months of 1934 showed an increase of 29 per cent over the same period of 1933, and 40 per cent over the same period in 1932. In view of this, the Institute of Makers of Explosives is renewing its efforts to warn children, parents, others who have charge of children, and users of explosives, of the dangers of blasting caps. They are being asked to do what they can that these accidents may be reduced and, if possible, done away with entirely.

Blasting caps, used to explode dynamite, are often dropped by careless workmen at or near where they are blasting. If children get hold of these and hammer them, throw them in a fire, or otherwise play with them, they will almost certainly explode like a small hand grenade, and particles flying in all directions will maim or cripple the children. Warn children that if they

see one, not to touch it but to report it to the nearest police or their parents.

Gohi President Re-Elected

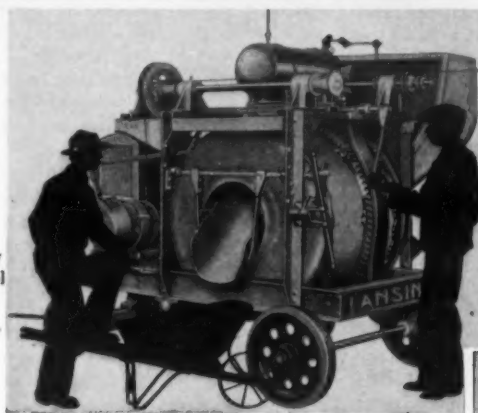
Gohi Culvert Mfs., Inc., at its recent Cincinnati, Ohio, meeting, re-elected E. B. Abbett as President. He is also President of the National Corrugated Rolled Metal Culvert Pipe Assn. and Chairman of the Code Authority for that industry.

This is Mr. Abbett's sixth term as President of Gohi Culvert Mfrs., Inc., and his second term as President of the National Corrugated Rolled Metal Culvert Pipe Assn. He has been General Manager of the Newport Culvert Co., Newport, Ky., since 1927.

New Concrete Paving Manual

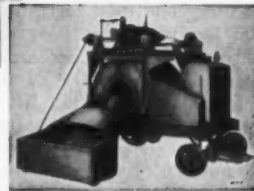
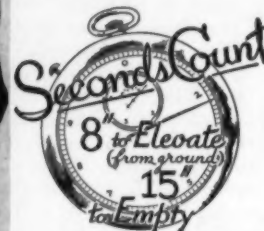
A new 72-page "Concrete Pavement Manual," No. 5 in the highway planning and design series, published by the Portland Cement Association, 33 West Grand Ave., Chicago, Ill., is available gratis to all readers of CONTRACTORS AND ENGINEERS MONTHLY by writing to the Association and mentioning this magazine. This book is a compilation of up-to-the-minute methods of design and construction for roads and streets, with special attention given to width, curves, thickness, joints, reinforcement, crown, drainage, bases, subgrade, finishing, curing, traffic lines and maintenance.

Any real Project demands a real Mixer—



Capacity
(Per Batch)
10
CU. FT.

WITH QUICK, EASY
1-MAN CONTROL



LANSING 10-S MIXER

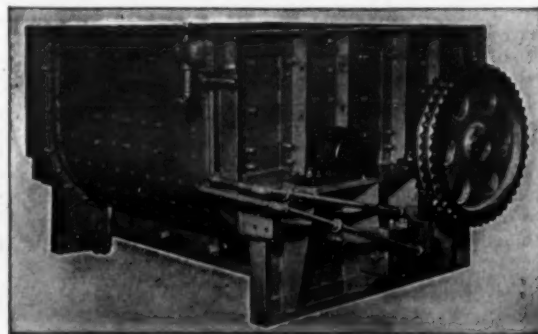
Fast in operation, easy to control, the Lansing 10-S Mixer gives real performance anywhere, any time. Powered with 12-H.P. LeRoi 4-cylinder gasoline engine. Alemite pressure lubrication. Thirteen heavy-duty Hyatt bearings make for long life and easy running. Wheels—rubber tired. Write, wire or phone for Bulletin of complete details and prices.

LANSING

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CHICAGO NEW YORK PHILADELPHIA BOSTON LANSING MICHIGAN MINNEAPOLIS KANSAS CITY SAN FRANCISCO

STEAM-JACKETED STEAM-OPERATED ASPHALT MIXERS



Compact
Design
Welded Steel
Construction
Anti-Friction
Bearings
Adjustable &
Removable
Blade Tips

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Builders of Asphalt Paving Machinery for 30 Years

STONE AND GRAVEL CRUSHERS



A combination jaw crusher and roll crusher gravel plant with capacity of 500 to 1500 yards 1-inch material daily depending on the amount of oversize.

UNIVERSAL CRUSHER CO.,

620 C Avenue, West, Cedar Rapids, Iowa

CRUSHING, SCREENING AND
LOADING PLANTS FOR EVERY
JOB

Contractors, counties, states and municipalities everywhere are producing crushed stone and gravel with UNIVERSAL equipment. A complete line of sizes in many portable combinations built for quality, dependability and economy. The original overhead eccentric type crusher backed by 28 years of manufacturing and designing skill.

Send details regarding your
problem and ask for catalog

Kanawha River Dams Use Roller Gates

(Photo on page 40)

The new lock and dams projects on the Kanawha River at London and Marmet, West Va., are among the first in this country to use roller-type gates which have been so successful abroad. The new dams are replacement structures of four dams built between 1880 and 1887. Both installations are identical, briefly consisting of twin locks on one bank flanked by an across-stream dam of five roller gates between concrete piers.

The roller gates are hollow steel cylinders approximately 20 feet in outside diameter and 108 feet long. At each end of each drum is a sprocket engaging an inclined rack set in the side of the piers for the raising operation. The rollers are raised by machinery set in the top of each pier, which operates a double-link chain wrapped around the drum. As the gates are hoisted, the surplus chain is automatically racked in a recess at the top of the pier.

The drum of one of the five roller gates is of smaller diameter than the others and is provided at the top with a movable flap hinged to it. This flap is actuated independently of the gate proper and can be lowered onto the drum to provide a maximum depth of overflow of 5 feet for the purpose of passing surface drift and debris. The gates are raised from one end only. The other end of the drum rolls up the rack, but no power is applied at that end. The operating mechanism for each gate is independently controlled. An electric motor does the lifting through reduction gears. The rollers raise a maximum vertical distance of 43.4 feet at a speed of 9 inches in a minute.

Value of Roller-Gate Dam

Adoption of roller-gate dams on the Kanawha, and for other recent installations, is based in general on the condition that the provision of open-river navigation is not of sufficient importance to outweigh the advantages of this type, and on the fact that the non-navigable dam is more dependable, less hazardous to operate and can be repaired more readily and with less hindrance to navigation. The long gate clearance for passing ice floes and drift is also an advantage where these occurrences have to be considered. On the Kanawha, the influencing conditions were the comparative unimportance of open river navigation and the operating advantages of the roller-gate dam, but special provision for ice was made at one of the gates. One important reason for adopting roller gates rather than sector gates was the fact that the sill had to be within 6 feet of the river bed to obtain sufficient discharge capacity in floods. This prevented the use of sector gates, which could not be lowered without making an excavation in the river bed which would fill up with sediment.

Asphalt Standards Reaffirmed

The National Bureau of Standards through its Division of Simplified Practices has announced that Simplified Practice Recommendation R4, Asphalt, has been reaffirmed, without change, by the standing committee of the industry. The recommendation, which covers the penetration limits of paving asphalt, first became effective January 1, 1924. It was reaffirmed and re-issued in 1926, and again reaffirmed in 1928, 1930 and 1932.

The recommendation is being reprinted, and until the new edition becomes available, mimeographed copies may be obtained without charge from the Division of Simplified Practice, National Bureau of Standards, Washington, D.C.



Cleaning Old Paint from Steel Bridge
with Portable Outfit

Scaling Hammer Outfit for Bridge Maintenance

The G. W. Causey Co., Pittsburgh, Pa., which does a lot of bridge maintenance work for the Allegheny County Highway Department, has recently purchased two electric scaling hammers operated by a gas-electric generating set which makes it possible for them to prepare an ordinary 15 to 20-foot steel highway bridge for painting in one day. The first of these outfits was so successful that a second has already been ordered and placed in service.

The outfits are easily handled by two or three men who move them about on the job and load them onto a light truck for removal.

The two scaling hammers, made by the Syntron Co., Pittsburgh, Pa., are of the simple magnet construction, with no motors, gears, etc., incorporated in their design. Their blow has been determined to be exactly right for removing paint, scale and rust, and yet will not damage the metal or the rivet heads. The scaling speed of these hammers is said to be from seven to ten times as fast as the same work can be done by hand.

The Syntron gas-electric generating set which furnishes power for the operation of these hammers consists of a small, single-cylinder, air-cooled gasoline engine, direct-connected to a 110-volt, 60-cycle, single-phase, alternating-current generator of 1/2-kw capacity. This gas-electric set is very small in size, weighs approximately 300 pounds and can be very easily hauled around on a very light truck. In addition to furnishing power for the two scaling hammers, the gas-electric plant can also be used to furnish light on construction work at night, or for the operation of other portable electric tools such as drills, reamers, grinders, concrete vibrators, etc.



Brick Masonry Bridge near Newcomerstown, Ohio

Reinforced Brick Masonry For Eastern Ohio Bridge

The Ohio State Highway Department has recently completed a beam bridge of two 32-foot skew spans and 24-foot clear railway, on the Millersburg-Dover Road, State Route 341 near Newcomerstown, Ohio. The abutments and pier are of reinforced brick masonry with concrete footers.

The faces were laid up common bond, using headers every sixth course. The

beams were faced with brick. The special treatment given panels in the brick railing served to increase further the attractiveness of the job. The design and construction were under the supervision of J. R. Burkey, Engineer of Bridges of the Ohio Highway Department. This was a PWA Federal-Aid Project.

80 Per Cent of Rural Roads Financed by Motor Taxes

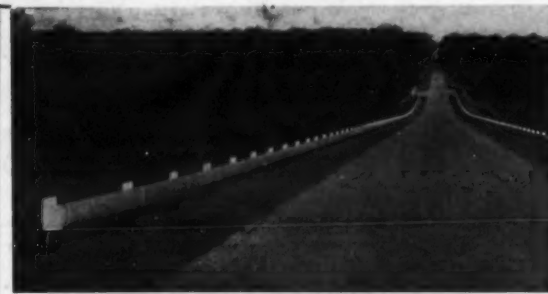
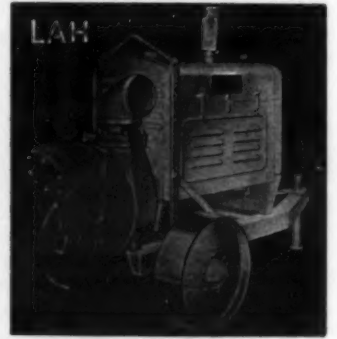
Speaking of "Who Shall Use the Highways and How," the American Association of State Highway Officials points out that "rural highways on the State System are financed over 80 per cent by motor license fees and the gasoline tax. Hence the cry about necessary additional property tax in order to make highway improvements is unwarranted."

DEPENDABLE Self-Priming PUMPS

2 in. — \$125 4 in. — \$260
3 in. — 185 6 in. — 785
8 in. — \$1000

Ask for Literature

STERLING MACHY. CORP.
411 Southwest Blvd., Kansas City, Mo.



Tuthill Guard Rail—Low Cost, High Efficiency

TUTHILL HIGHWAY GUARD

The strongest and most effective steel plate guard rail.

The easiest guard to erect.

ASK FOR COMPLETE DATA

Tuthill Spring Co., 760 Polk St.,
Chicago



Cross Section of
Tuthill Guard



Profit by the experience behind modern Bucyrus-Erie Shovels

Bucyrus-Erie experience covers the building, in the United States and England, of over 15,000 excavators and cranes, and nearly 4,000 churntype drills—far more than have been produced by any other manufacturer. These machines have been used in practically every country of the world, and under all manner of conditions have successfully met the tests of every kind of work. This tremendous volume of valuable experience is reflected in the practical convenience, the dependable performance, and the sustained high output which are characteristic of Bucyrus-Erie equipment.

**BUCYRUS
ERIE**

BUCYRUS-ERIE COMPANY

South Milwaukee, Wis., U.S.A.

Excavating, Drilling and Material Handling Equipment.

CCC Erosion Project Terraced with Tractor

(Photo on page 40)

On an experimental CCC erosion project in the Wasatch Mountains near Bountiful Park, north of Salt Lake City, Utah, a tractor and trail-builder did the terracing. Several disastrous cloud-bursts had occurred in Parish Canyon and the sudden flood of water carried with it dirt and debris into the populated valley below, disrupting traffic and causing much property damage.

It is something unusual to build terraces on a mountainside with a trail-builder. The trail-builder blade, mounted on a McCormick-Deering T-40 Trac-

Tractor, was tilted and then worked along the top on a return trip to make an even slope from the contour of the mountain to the toe of the terrace. This was necessary for, if there were any sudden drop or jog above the terrace, erosion would quickly start and fill up the terrace. Some 90 miles of terrace of this type were built in this region during the 1934 construction season. There were 222 CCC boys at work on this project under C. R. Wehmeyer, Superintendent.

Winter is here! Cold weather can freeze water lines, and heat can start fires if improperly controlled. Temporary salamanders have caused fires with losses in the millions of dollars. Watch your step. Prevent fires.

Longest Electric Cable Spans Columbia River

Electric power for Mason City, the contractors' town at the site of the Grand Coulee Dam, 92 miles west of Spokane, Wash., is carried across the Columbia River by a cable span 3,087 feet in length, longer than any other similar span in the world.

This 110,000-volt transmission line of the Mason-Walsh-Atkinson-Kier Co., which will build the first, or \$63,000,000, unit of the dam, had to be stretched some thirty-odd miles from the dam site to connect with the already established power line. When the power was turned on, Mason City was made the world's first 100 per cent electric city.

South American Road Built to Illinois Specifications

Christened by newspapers "The Road to Buenos Aires," a new highway connecting Montevideo, Uruguay with Buenos Aires, Argentine, was opened early in January, making possible an automobile trip over the 177 kilometers, 106.2 miles, between the two capitals in five hours, including 2½ hours on the ferry across Rio de la Plata.

According to a United Press dispatch from Montevideo, the road is concrete, built to Illinois specifications, and is practically straight. Although the cost was originally estimated at \$6,000,000, the construction of numerous feeder lines increased the final cost to \$12,000,000.

ASPHALT

for all types of road construction
is definitely here!

ASPHALT pavements have taken the lead today. They meet public demand for smooth, economical and safe pavement.

Asphalt construction can be adapted to every local paving problem.

Meeting varied problems of traffic and supplying the miles of paving required, with funds available, is simplified by asphalt types of construction.



Lake Shore Drive, Chicago.
Stanolind Cut Back Asphalt

Liquid Asphalt—For dust-prevention; for waterproofing ordinary earth, dirt, clay or gumbo roads; for building up a wearing course by mixed-on-the-road methods.

Cut Back Asphalts—For surface treatments in one, two, or three applications; for re-tread or mixed-in-place surfaces; for asphaltic concrete (cold mix); for asphalt macadam pavement

(penetration method); for maintenance and repair work.

Paving Asphalts—For hot mix sheet asphalt, hot mix asphaltic concrete and all types of pavement in which bituminous or asphaltic cements are used.

Also — Stanolind Asphalts for Special Uses



Above: A typical example of the use of Stanolind Asphalt Cement.



Right: An example of the use of Liquid Asphalt—used in thousands of miles of pavement in the United States each year.

STANDARD OIL COMPANY

910 S. Michigan Avenue

(INDIANA)

Chicago, Illinois

Copr. 1935, Standard Oil Company

ASPHALT

for every Purpose

ASPHALT FOR PAVING... ASPHALT

More Structural Steel Shipped in 1934

Over 1,100,000 tons of structural steel was fabricated and shipped during 1934, according to a recent release from the American Institute of Steel Construction. This represented an increase of approximately 20 per cent over the amount fabricated and shipped during 1933. During the same period the bookings have nearly approximated the

shipments, wherefore the industry started the new year with a backlog of work about equal to what it was this time last year. This is the first time in four years that steel construction has looked up!

The fabricators of structural steel have been for many years the largest consumers of the output of the steel industry. It ranks along with the automotive industry and the railroads as purchasers from the mills. The situation in this industry therefore has a very

important bearing upon the basic steel industry and likewise is indicative of conditions existing in the field of general contracting because the product, structural steel, goes chiefly into buildings and bridges.

Fall Bituminous Treatment Prevents Winter Raveling

More than 300 miles of graveled roads were given bituminous treatment by the Maintenance Division of the Minnesota

State Highway Department in six weeks last fall. Much of this work was on projects which had been given new gravel surfacing, and the bituminous treatment will prevent the gravel from being dissipated by traffic and the elements, besides making the roads smooth and dustless. Without treatment, there would be a heavy loss of gravel during the winter months. With the work done in the fall, there will be no delay or inconvenience to motor traffic next spring and summer.



At NORRIS DAM
the CEMENT and STEEL

is hauled by

INTERNATIONAL TRUCKS

Originally a railroad was planned to get the vast tonnage of cement and reinforcement steel from the railroad siding at Coal Creek, Tenn., up to Norris Dam, but a show-down on efficiency gave the job to trucks—INTERNATIONALS.

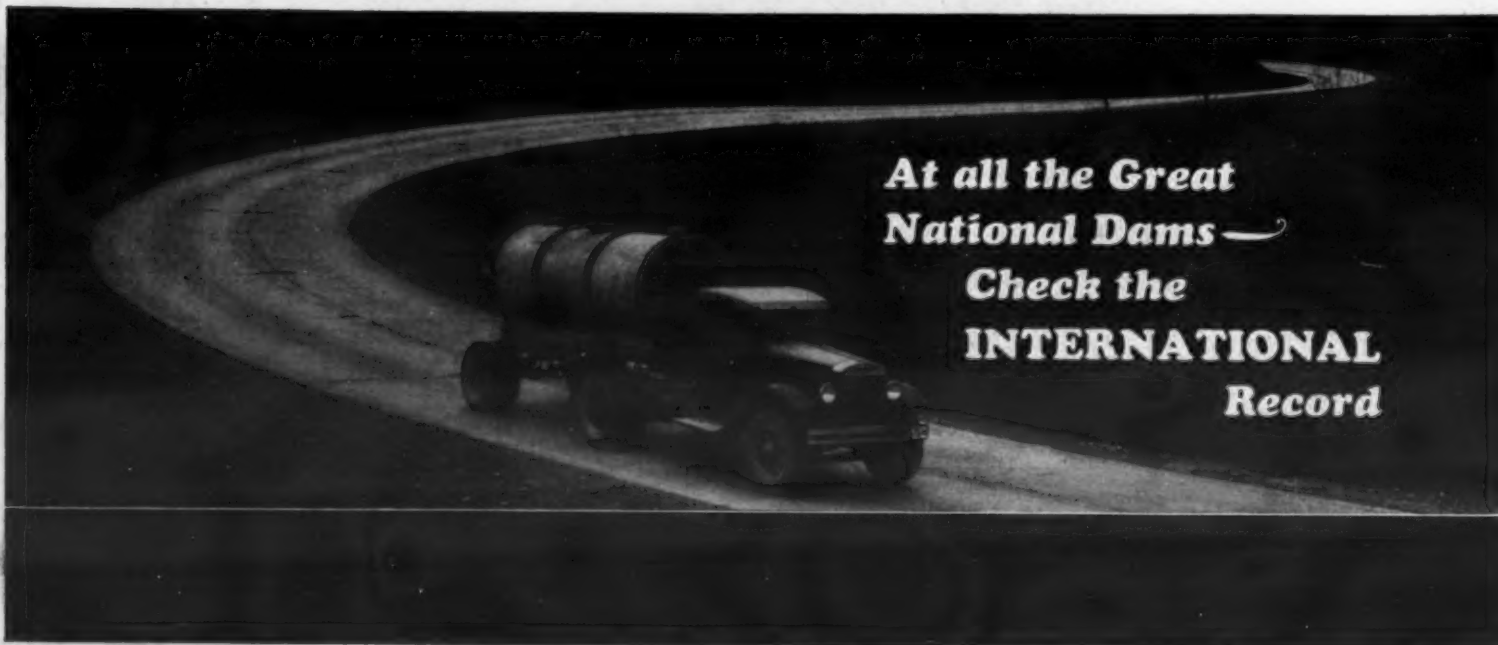
A scenic highway 4.8 miles in length was built up the steep grades (eventually it will continue on over the completed dam) and a fleet of International Model A-8 tractor-trucks with semi-trailers got onto the job, to carry on twenty-

four hours a day during the many months of dam construction. The aluminum tanks of the trailers hold a capacity of 65 bbl. or 24,440 lb. of cement. Steel and lumber are hauled on other types of trailers.

On the Tennessee Valley projects, as on the most spectacular construction enterprises elsewhere in the country, International Trucks are playing a generous part, consistently dependable, efficient, economical.

Service through 217 Company-owned branches.

INTERNATIONAL HARVESTER COMPANY OF AMERICA, INC.
606 South Michigan Avenue, Chicago, Ill.



At all the Great
National Dams—
Check the
INTERNATIONAL
Record

Conc
75

excavation
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Concrete Pumped 750 Feet for Dam

(Continued from page 17)

excavation on July 27, concreting on October 26 and earth backfill on the same date. The contract was completed in January, with the core wall carried to Elev. 455 and the fill to Elev. 460. It is expected that contracts for the remainder of the construction to carry the flow line to Elev. 630 will be awarded during the summer of 1935. This later construction will carry the top of the earth work to Elev. 545. The total capacity of the reservoir will be 92,000 acre-feet with a maximum length of 8 1/2 miles and a water area of 2,050 acres.

Quantities of Present Contract

Clearing and grubbing	10 acres	\$50.00
Soil removed	27,000 cubic yards	.30
Earth excavation	120,000 cubic yards	.40
Rock excavation	40,000 cubic yards	1.00
Special preparation of rock surfaces	4,000 square yards	.50
Earth fill in cofferdams	25,000 cubic yards	.40
Rock fill in cofferdams	36,000 cubic yards	.30
Riprap	2,700 cubic yards	1.00
General fill, 12-inch layers	350,000 cubic yards	.30
General fill, 8-inch layers	85,000 cubic yards	.30
Soil core and soil blanket	75,000 cubic yards	.35
Selected fill, 6-inch layers	20,000 cubic yards	.35
Tile drains, 8-inch and less	2,500 linear feet	.35
Tile drains, 10 to 15-inch	3,700 linear feet	.75
Concrete masonry core wall	16,500 cubic yards	4.50
Concrete diversion conduit and portals	3,200 cubic yards	5.80
Concrete 2-gate houses	1,800 cubic yards	7.00
Concrete retaining walls	3,400 cubic yards	4.90
Concrete lining channels	1,350 cubic yards	5.00
Drilling holes in rock and masonry	5,000 feet	.30
Furnishing and placing grout	100 cubic yards	9.00
Portland cement	37,000 barrels	2.30
Reinforcing steel	350,000 pounds	.63%

Labor and Hours

The Bills Brook Dam project is not a Construction Code job. Labor worked a 10-hour shift per day and work was continued six or seven days a week as necessary to facilitate progress in accordance with the construction schedule.

Shops and Service Units

A blacksmith shop located about 300 yards south of the center line of the dam contained an Ingersoll-Rand oil forge and pneumatic sharpeners. Adjacent to it was the machine shop containing a power hack saw, a Whitcomb lathe, a Hill, Clarke & Co. drill press and a Manly press.

A Reo service truck with a Continental motor and an electric generator mounted on the flat bed, and carrying an electric welding outfit, was maintained on the job and was constantly in service handling repairs and general service.

Preliminary Investigations by Water Bureau

The Water Bureau cleared the site of the dam and the area of the borrow pits at a cost of \$5,500 before bids were asked for the construction of the dam. This was of decided benefit in creating a favorable impression upon the contractors bidding and permitted them to examine more readily the dam site and borrow pit area before bidding.

Similarly a skilled mason was employed to set up a masonry wall, which was torn down and set up several times, to serve as a sample for the general design or pattern of the facing of the lower gate house. Thus, a masonry contractor bidding on this work knew exactly the type of work which was expected of him before he placed his bid and consequently did not have to

add a certain percentage for the trials and errors which many contracting parties require before a suitable type of masonry is secured.

Personnel

The East Branch Storage and Compensating Project including the Bills Brook Dam and appurtenant structures is being built by the Water Bureau of the Metropolitan District of Hartford County, as part of its water supply development. Caleb Mills Saville, Manager and Chief Engineer, with A. Kline as Division Engineer is in charge of construction. The contractor was the C & R Construction Co. of Boston, Mass.; Daniel P. Kelly, President; Thomas C. Russo, Treasurer; and A. Martinelli, Superintendent.

The Consulting Engineers for the project were Robert Ridgway, former Chief Engineer, Board of Transportation, New York City, and a member of the Hoover Dam Commission; the late J. Waldo Smith, former Chief Engineer, Board of Water Supply, New York City; and Frank E. Winsor, Chief Engineer, Metropolitan District, Water Supply Commission, Boston, Mass. General supervision for the State of Connecticut is by William G. Smith of Waterbury, member of the State Board of Civil Engineers.

Changes in Sales Staff of Fairbanks-Morse

A. B. Jacobus, for the past several years Manager of General Scale Sales in the Chicago office of Fairbanks, Morse & Co., has recently been made General Manager of E. & T. Fairbanks & Co., St. Johnsbury, Vt., according to an announcement made by the Fairbanks, Morse & Co., Chicago. George C. Worthley, formerly Manager of the Scale Department in the New York Branch, has been transferred to Chicago to fill the vacancy caused by the transfer of Mr. Jacobus.

E. & T. Fairbanks & Co., established in 1830 by the Fairbanks brothers, is a subsidiary of Fairbanks, Morse & Co., engaged in the manufacture of the company's extensive line of weighing equipment.

The Indiana and Michigan Highway Departments in 1934 awarded sizable contracts for brick resurfacing, following successful experiences in Illinois, Ohio and other states.

Getting Winter Jobs By Advertising

H. F. Stimm, Inc., Buffalo, N. Y., last winter went out after winter concrete work from factories that usually did their own concrete work. He sent letters proving the value of contract work and lined up some very interesting jobs. One of them was the installation of car transfer tracks for the Eastern States Milling Co. in Buffalo. This job was done in the period between November 25 and February 1, in weather that averaged well below freezing and the lowest average daily temperature was 5 degrees below zero. The principal concrete work was the construction of a

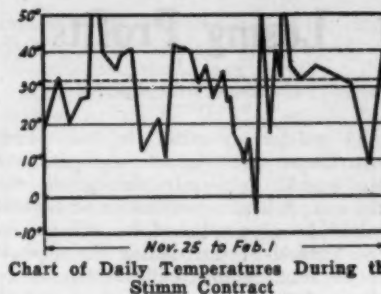


Chart of Daily Temperatures During the Stimm Contract

55 x 225-foot transfer table, built in December and January. It consisted of foundation walls 3 feet deep by 1 foot thick, cast monolithically with a heavily reinforced 6-inch slab. Ready-mixed concrete was used.



Many city, county and state highway departments have found the 300 gallon No. 75-OB Trail-O-Heater with Motor Spray Attachment to be the answer for low cost maintenance. Other kettles in sizes from 10 to 1500 gallons.

There is

LITTLEFORD EQUIPMENT

for Large and Small Bituminous Jobs

Whether your highway jobs are large or small—patching or surface treating—you'll find the kind of equipment you need in the Littleford Line of Road Maintenance Equipment. It includes Pressure Distributors ranging in sizes from 300 to 1500 gallons. . . . tar and asphalt kettles of all kinds and sizes. . . . surface heaters. . . . joint fillers. . . . tool boxes. . . . and a wide variety of paving tools and pouring pots. Select the outfit that will do your job right. Send for our complete catalog—you will be under no obligation.

LITTLEFORD

Road Maintenance Equipment SINCE 1900

LITTLEFORD BROS. 485 E. PEARL ST. CINCINNATI, O.

The very latest . . .

in 3/8-yard excavators

This Bucyrus-Erie 10-B has something new in speed, power, mobility . . . something new in output. Contractors who have seen it work are buying it for what used to be considered 1 1/2 yard or larger jobs. It carries only a 3/8-yard dipper to be sure, but it's the yardage total at the end of the shift that governs your profits rather than the dipper size. May we show you some of the reasons why you should consider this hustling 10-B for your next job?



BUCYRUS-ERIE COMPANY
SOUTH MILWAUKEE, WIS.
Excavating, drilling, and material handling equipment

**BUCYRUS
ERIE**

● New 2" Marlow

SELF-PRIMING CENTRIFUGAL PUMP

Features of this pump:

- Easily carried by one man
- 100% automatic, self-priming
- No handles or petcocks to be adjusted
- Four-cycle engine with oil reservoir in crankcase
- Easy to start—Speed control—Air cleaner
- Foot and rope starters—Self-oiling
- Engine has only one place requiring lubrication

Ask for Specification Sheet 20A

Manufactured by
MARLOW PUMPS, Ridgewood, N.J.

Losing Profits

(Continued from page 14)

A satisfactory mixer is one which distributes each size of aggregate and the asphalt uniformly throughout the mix. A better distribution of asphalt might be accomplished by changes in the method of introducing the asphalt in the mix. Studies indicate that where the asphalt is introduced at a single point it should be admitted gradually. The greater the dispersion of the flow the greater the speed of flow which can be permitted and still obtain uniform coating of aggregate. Chutes with diverging channels have been used to spread the asphalt over a large area of aggregate. It is believed that improved results might be obtained by forcing the asphalt through pipes leading to a number of points in the mixing box. A piston could be arranged to supply the pressure, with the piston adjusted so as to measure the correct amount of asphalt for a batch. In general, the time required for asphalt distribution is greater than that required for aggregate distribution. It seems possible that practical methods of accelerating asphalt distribution can be developed and this should permit a reduced mixing cycle and increased production.

Wide variations in mixing time were found on practically all of the projects studied. Figure 10 shows the results of the timing of over 280,000 mixing cycles. The observations have been grouped at 5-second intervals and the number of observations in each group plotted as a percentage of the total number of observations in the group. On a typical project in an eastern state more than 70 per cent of the batches were mixed either more or less than the specified time of 45 seconds.

The typical western project shows a somewhat closer adherence to the 45-second mixing time.

The wide variation in the mixing time found on practically all projects indicates the need for a timing device to control the mixing period. There is also need for research to determine the efficiency of different arrangements of mixers and the mixing time required under any set of conditions.

It has been definitely demonstrated that marked improvements in efficiency of mixing are possible. Representatives of the Bureau of Public Roads co-operated with an asphalt plant manufacturer and a contractor to develop a pugmill of improved design. The ordinary design was altered by decreasing the length of mill and increasing the width and depth. The net volume was increased by reducing the size of paddle

and shaft connections. These changes permitted a higher speed of paddle rotation. This machine made possible the lowest mixing cycle yet observed and a record breaking production with full adherence to specifications. A consistent charging time of 4 seconds was obtained ("split" charging not necessary) as compared with an average of 9.9 seconds on other work. A large discharge opening was used through which a batch could be discharged in 3 or 4 seconds as compared with an average discharge time of 13 seconds. No change was made in actual mixing time. The mixing cycle was 51 seconds as compared with an average of 61 seconds.

A box for storage of mixed batches, commonly called the "gob box", is essential to allow for temporary differences in mixer production and hauling rate. If the size of batch is less than a truck load a storage box is the only means of avoiding a wait on every truck trip. In such cases delay is wholly unwarranted when so simple and inexpensive a remedy exists.

(To Be Continued in March)

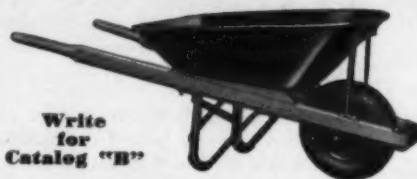
New Head for Rock Drill Co.

A. H. Skaer, formerly associated with the Denver Rock Drill Mfg. Co. and for many years its president, has been placed in charge of the Cochise Rock Drill Mfg. Co., a subsidiary of the Independent Pneumatic Tool Co., of Chicago. Mr. Skaer will make his headquarters in Los Angeles where the Cochise plant is located.

Worthington Regional Office

The Worthington Company, Inc., Harrison, N.J., has recently established Pacific Coast regional headquarters at 510 W. 6th St., Los Angeles, Calif., with C. E. Wilson, Vice President, in charge. This new regional office will have jurisdiction over the district offices in Seattle, San Francisco, Los Angeles, and El Paso.

SUPERIOR EARTH MOVING EQUIPMENT



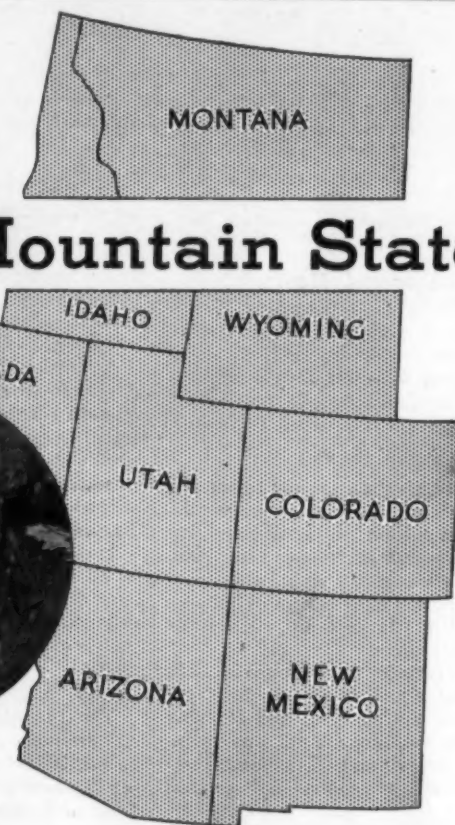
Write for Catalog "B"

Wheelbarrows—All types
Drag Scrapers
Fresno Scrapers
Wheeled Scrapers
Grading Plows, Rooters
Also Tractor Equipment
Rotary Scrapers
Scarifiers, Rippers
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The Slusser-McLean Scraper Co., Sidney, Ohio

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in the Mountain States



Meets copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts.

TO deliver trouble-free service for years beyond your reasonable expectancy is the common performance of GOHI Corrugated Pipe.

This phenomenal longevity is not peculiar to any one location or set of conditions. Everywhere throughout the nation where traffic abuse is most severe, where wear, weather and corrosion, alternate freezing and thawing, settling and shifting fills would completely destroy ordinary drainage structures, GOHI Pure Iron-Copper Alloy proves itself the longest-lived, low-cost culvert metal you can buy.

Get all the facts. Consult the fabricator nearest you.

F. Yeager Bridge & Culvert Works, Port Huron, Mich.
Bancroft & Martin Rolling Mills Co., S. Portland, Me.
Denver Steel & Iron Works Co., Denver, Colo.
Feenaughty Machinery Co., Portland, Oregon
St. Paul Corrugating Co., St. Paul, Minn.
Capital City Culvert Co., Madison, Wis.
The Newport Culvert Co., Newport, Ky.
New England Bolt Co., Everett, Mass.
Tennison Brothers, Texarkana, Ark.
Central Culvert Co., Ottumwa, Iowa
Lane Pipe Corporation, Bath, N. Y.

GOHI

PRONOUNCED "GO-HIGH"

CORRUGATED PIPE

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20' Back-up Spread, 1/2" Chips

KOB Disc Spreader
patented 1929

Spreads sand, gravel, chips, shale, cinders, or chloride.

Fits any dump truck, large or small.

Makes icy hills and curves safe.

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KOB MFG. CO.

520 E. Brown St., Milwaukee, Wis.



The Erie Grab Bucket Equipped with Westinghouse Special D-C Motor

Improved Grab Bucket Carries Own Motor

Improved motor-driven grab buckets, ranging from $\frac{1}{2}$ to 3 cubic yards capacity for contractors handling limestone, dolomite, slag, sand, cinders, and similar bulk material, are announced by Erie Steel Construction Co., Erie, Pa., equipped with Westinghouse special d-c control which makes possible the use of only two conductors between the control cab and bucket. Since each bucket carries its own motor, they can be attached to cranes, monorail hoists or any hoisting equipment at which electric power is available. After the hoist block hook slips into the holding yoke of the bucket and an electrical connection is made by a simple plug device, the bucket is ready to go to work.

The Westinghouse crane motor, brake and gearing are mounted in the bucket head. Either an alternating or direct-current motor can be used. The coupling between the motor and worm gear serves as a braking wheel. All parts are lubricated by the forced Alemite system. Annealed acid-electric steel castings are used.

The bucket has been designed for proper balance, equalization of strain to prevent warpage, and the heavy, plate scoops are reinforced with hardened cutting edges. The scoops are so hinged that the height varies little whether they are open or closed. A bucket of 1 cubic yard, for example, is 6 feet 6 inches high when closed, and 7 feet 9 inches when open.

The power-arm type of construction results in a minimum number of moving parts on the hinge pin, reduces wear, and preserves scoop alignment. Special teeth can be attached to the cutting lip for hard material, making it a digging bucket as well as an efficient rehandling bucket.

Air-Cooled Compressors With Two Stages

Portable air compressors that are air-cooled, have two stages of compression and are operated by 6-cylinder engines, offer the construction man something to think about. Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, has recently announced its new line powered with low-gasoline-consumption Hercules engines or Hercules full diesels.

The manufacturer claims simplicity, as there are no more parts than the single-stage type and only one connecting rod on each crank pin. The large crankcase doors give easy access to the bearings, and all cylinders, valves, etc. are conveniently located. Greater economy is secured through better intercooling, low air velocities, force-feed lubrication and the new gas engine or diesel power. There are fewer parts to maintain and maintenance costs are reduced through the use of full-floating piston

Thick Cotton Mats Equal Burlap Curing

A report on the studies of the use of cotton mats for curing concrete pavements was published in the July, 1933, issue of *Public Roads*. Further tests were made last winter at the Arlington Experiment Station, using a number of small 6-inch concrete slabs cast with their upper surfaces level with the surface of the ground and with a thermocouple embedded at a depth of $\frac{1}{4}$ -inch in the center of the upper surface of each slab. The mats used were made of cotton fibre of weights of 10, 30, 60, 90, 110, and 170 ounces of cotton filler per square yard held in place between sheets of loosely woven covering cloth by stitching or tying. The 90, 110 and 170-ounce mats were 3, 6 and 9-ply respectively.

The chief purpose of these tests was to compare the curing efficiency of the thinner mats with the 3-ply and over mats. Results of the tests showed that in all cases specimens cured with dry mats showed appreciably lower strengths at 28 days than those cured under wet burlap. The average strength for all specimens cured under dry mats is roughly 88 per cent of the strength of specimens cured by the standard method, which checks approximately the results which were previously obtained.

Thick Mats Have Edge on Thin

The reason for the lower strengths is, of course, the moisture loss suffered by the specimens during the 3-day curing period. In the case of mats which were thoroughly wet before application, the specimens developed an average strength at 28 days approximately equal to that of specimens cured by the standard method. The thinnest mats resulted in slightly lower strengths, while the thickest mats resulted in strengths slightly above the standard.

Since the thinner mats, when exposed to the direct rays of the sun, might permit a higher moisture loss than was noted in the laboratory, it is recommended that such mats be used only under conditions specified for burlap; that is, kept continuously wet during the 3-day curing period.

With these limitations in mind, the U. S. Bureau of Public Roads reports that these tests substantiate the previously published conclusion to the effect that cotton mats of the thicknesses and weights shown, if wet once and applied with the wet side down, are as effective in curing as a double thickness of burlap kept wet continuously for three days and also that mats applied dry are less effective than either the wet mats or the burlap.

pins which prevent seizure or cylinder scoring. Simplate valves which are simple, durable and efficient are used; the free air unloading system is economical; there is a self-adjusting trouble-free clutch between the engine and compressor; and the unit is mounted on a cast steel deck.

This new line of compressors is made with actual capacities of 105, 160, 210 and 315 cubic feet of free air per minute delivering the air at 100 pounds pressure.



One of the New C-P Portable Air Compressors

Seven 1935 Trucks Announced by Ford

Although the announcement of the 1935 Ford V-8 trucks by the Ford Motor Co., Dearborn, Mich., states there are 49 improvements, there is but one change in the 80-horsepower V-8 engine, namely, a directed flow crankcase ventilation system. The double-duty line for 1935 includes seven types in which there is better load distribution, improved driver comfort and special attention to smartness of appearance.

The truck is available in two wheelbases, 131 $\frac{1}{2}$ -inch in panel, platform, stake, hydraulic dump, cab and chassis with dual wheels and auxiliary springs for tractor use; and 157-inch chassis in the platform and stake types.

Giant Stripping Shovel Has 22-Cubic Yard Dipper

A new stripping shovel, with dippers up to 22 cubic yards and a working weight of 2,400,000 pounds, was recently announced by Bucyrus-Erie Co., South Milwaukee, Wis. This 950-B is readily convertible to shovel or drag-line operation, and has a remarkably fast digging cycle. It is available with

booms up to 110 feet, with dipper handles up to 70 feet and with dippers of 14 to 22-cubic yard capacities.

Individual motors in each of the four crawler units give variable speeds for turning, which is simplified by hydraulic steering, minimizing the slewing of units and the skidding of belts. The manufacturer claims that this big stripper has outstanding ability to move overburden rapidly, continuously and economically.

KEEP THEM DOWN!

WITH

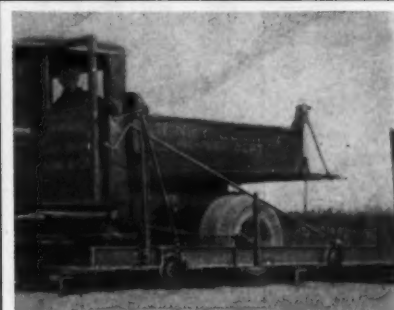


for the production of Concrete Blocks, Building Tile and Concrete Bricks. Write for circular

Miles Manufacturing Co. Jackson Mich.

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First Cost Production Costs



The BURCH UNDR-TRUK ROAD MAINTAINER

Produces distinctly better roads at definitely lower cost!

Seven blades, instead of the usual one or two. Easily carried by truck (with blades raised), so no time is lost in getting to the next job.

Write for circulars on this and other BURCH equipment: Side-Of-Road Shoulder Maintainers, Stone and Asphalt Spreaders, Trench Fillers, Crack Fillers, Portable Conveyors, etc.

THE BURCH CORPORATION CRESTLINE, OHIO

CONCRETE TO MOVE?



Pump it with the Rex Pumpcrete

The greatest development in placing concrete since man first built with cement. The Rex Pumpcrete has proved its ability to transport concrete up to one thousand feet, up to heights above 100 feet and to practically any intermediate combination without segregation, at lower yardage cost, and the concrete is better when it arrives.



Haul it with Rex Moto-Mixers

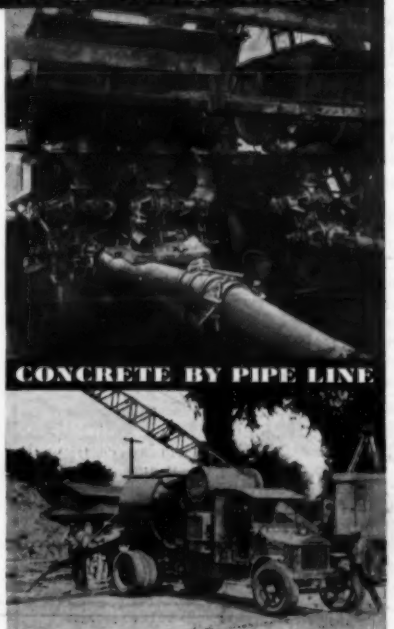
Where concrete is to be placed over a wide area, especially where traffic is at all congested, the Rex Moto-Mixer operating from the central batching plant is the most economical means of transporting, mixing and placing. Equipped with the Rex Jackson Hoist, it delivers concrete direct to the forms over a very wide spouting distance. It is frequently the answer to puzzling jobs.

Both

Recommended

Each one for the job it does best. Send the coupon for information on the equipment that interests you.

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REX PLANT MIXERS
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REX PUMPCRETE
Concrete by Pipe Line Rex Moto-Mixers Central Plants
SPEED PRIME PUMPS
2 inch 4 inch 8 inch

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For free distribution to contractors, engineers and officials. Write for the catalogs you need.

Pumps with Full Automatic Priming

295 Rex Speed Prime pumps, from 2 to 6-inch in size, all with full automatic priming, are described in Catalog 240 which the Chain Belt Co., 1666 West Bruce St., Milwaukee, Wis., will be glad to send on request.

Maintenance of Shoulders

296 Complete information on the Burch Side-O-Truk maintainer for shoulders which completes the job in one operation and, it is claimed, reduces the cost 75 percent, may be secured by interested contractors and maintenance engineers from the Burch Corp., Crestline, Ohio.

Asphalt Road Construction

297 Texas Co., Asphalt Sales Dept., 135 E. 42nd St., New York City, will be glad to furnish contractors and engineers with complete details of the use of Texaco asphalt in all types of bituminous road construction, including penetration macadam, hot-mix asphalt, asphaltic concrete, low-cost road-mix and resurfacing with cut-back asphalt.

Protection for Your Job

298 Complete protection for your job, the public and your pocketbook is secured, according to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland, Ohio, by Cleveland trench guards, a new barricade development with low initial cost and practically no maintenance required. Information may be secured direct from the manufacturer.

Wire Rope for Tough Jobs

299 Williamsport Wire Rope Co., 122 So. Michigan Ave., Chicago, Ill., invite contractors and others who have tough jobs requiring wire rope for heavy-duty service to write for complete information on Williamsport wire rope which is designed for just such jobs.

Reducing Wheelbarrow Hauling Costs

300 Sheet Aluminum Corp., Jackson, Mich., will be glad to send to those interested complete information on the Hyb-Lum wheelbarrow, which because of its construction of sheet aluminum and its pneumatic-tired wheel is claimed to reduce wheelbarrow hauling costs.

Traction Treads for Winter Operation

301 W. A. Riddell Co., Dept. C, Bucyrus, Ohio, will be glad to send complete information and prices on J. & S. traction treads for dual-tired trucks, tractors, graders and similar equipment, the use of which protects the tires and makes possible and profitable operation of such equipment during the winter, regardless of ground conditions.

Vibrating Screed Boards

302 Munsell Concrete Vibrators, 999 West Side Ave., Jersey City, N. J., will be glad to send to interested contractors and engineers complete information on the Munsell vibrating screed board for vibrating the concrete in slabs and pavements to produce a better concrete and which leaves a smooth finish behind the screed board.

Pump News for Contractors

303 A new 2-inch self-priming centrifugal pump, with 100 percent automatic priming, actual capacity up to 120 gpm and suction lifts up to 25 feet, has been announced by Marlow Pumps, Ridgewood, N. J.

Power for Construction Equipment

304 Complete information on Chrysler engines for use in construction equipment, which are claimed to be powerful, economical and long-lived, may be secured by those interested from Chrysler Motors, Amplex Division, Detroit, Mich.

A Tractor Dump Wagon

305 The Camel tractor dump wagon, which combines in one versatile heavy-duty unit the features of truck, tractor, trailer and bulldozer, is made by the Shunk Manufacturing Co., Bucyrus, Ohio, who will be glad to send full information on request.

Earth Moving Equipment

306 Slusser-McLean wheelbarrows of all types, drag, Fresno and wheeled scrapers, grading plows and rooters, scarifiers, rippers, bulldozers and similar equipment are described in Catalog B which the Slusser-McLean Co., Sidney, Ohio, will be glad to send on request.

New Diesel 6-Cylinder Tractor

307 Cleveland Tractor Co., Cleveland, Ohio, will be glad to send to those interested complete information on the new Cletrac diesel 40 tractor, among the construction features of which are a 6-cylinder engine and an electric starter.

Crushing and Screening Plants

308 Universal Crusher Co., 620 C Avenue West, Cedar Rapids, Iowa, will be glad to send to those interested literature describing the complete line of Universal crushing and screening equipment, in a variety of sizes and types to meet the requirements of construction jobs.

Heavy-Duty Trailers on Pneumatic Tires

309 Rogers Brothers Corp., 108 Orchard St., Albion, Pa., will be glad to furnish complete information on Rogers heavy-duty machinery trailers which are equipped with ten pneumatic tires with carrying capacity from 10 to 40 tons.

Steel Plate Highway Guard Rail

310 Complete data on Tuthill highway guard rail, made of strong and effective steel plate, easy to erect, with low cost and high efficiency, may be secured by interested contractors and engineers from the Tuthill Spring Co., 760 Polk St., Chicago, Ill.

Answering Road Maintenance Problems

311 Catalog 185, a 24-page booklet describing Galion motor patrol graders and how they can solve your road maintenance problems, may be secured by interested state and county highway maintenance engineers, as well as contractors and others interested in grading and maintenance, from the Galion Iron Works & Mfg. Co., Galion, Ohio.

Profits through Night Work

312 Night work can be carried on as well as in the daytime by the use of National Carbide V-G lights which are claimed to furnish daylight conditions for night work, spreading a full even beam of about 8,000 candlepower where it is needed. Complete information on these lights, as well as the V-G handy light and the National Carbide lantern, may be secured direct from the National Carbide Sales Corp., Lincoln Bldg., New York City.

For Speedy and Profitable Work

313 The complete line of Blaw-Knox construction equipment, designed for speedy and profitable work, and including cement and concrete handling equipment, forms, dirt-moving equipment and similar items, is described in literature which the Blaw-Knox Co., 2067 Farmers Bank Bldg., Pittsburgh, Pa., will be glad to send on request.

When it's tough going—
Use

Williamsport

the WIRE ROPE

with the reputation for doing a
GOOD JOB!

We make sure of the quality of Williamsport Wire Rope by a grueling series of tests. In the picture at the right you'll see one test by a two-story strength tester—a split-second photo—in the act of rupturing a 3-inch rope. This is only one of a score of tests made on our ropes you put into service—many of which are exclusive with Williamsport. Why not try Williamsport on your next replacement and discover this quality for yourself?

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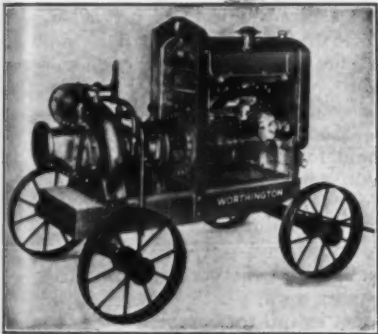
City -----

P.S. Also send me catalogs and
prices on -----

New Wellpoint System

A wellpoint system with a number of unusual features has been announced by the Griffin Wellpoint Corp., 60 E. 42nd St., New York, N. Y. The outstanding features are the Jet 'N Drive head which is particularly adapted for use in gravels, clay and hard subsoils which have been found practically impenetrable by ordinary jetting methods. The head is of the one-ball design, permitting quicker cleaning without pulling the wellpoint. Another feature claimed for this system is "Interflow," an arrangement by which water drawn from the soil flows between the drainage channels to prevent their becoming blocked. Still another feature of the design of these wellpoints is the 240 square inches of screen area, 100 per cent unblocked.

The wellpoint is of streamline construction, having the same outside diameter as the riser pipe, aimed to reduce friction loss and to insure complete salvage, as the head is strong enough to resist breaking when the points are pulled. The riser pipe is 1½ inches in diameter and the screen is 2.4 inches in diameter with a total area of 240 square inches. This screen is 32 inches long and consists of an outer and inner perforated brass tube, rolled in one piece for strength, the inner tube being corrugated, and with a mesh screen held firmly between the two tubes. Inside this is a 1.66-inch outside diameter galvanized pipe, threaded at the ends and perforated at the lower end. The head is attached to the lower end of this pipe by a threaded coupling and the riser pipe is similarly attached to the upper end.



The New Worthington Pump Designed for the Griffin Wellpoint System

The capped tee at the top of the Griffin wellpoint riser pipe is designed to take the blows of a small sheeting hammer so that the pipe is easily sunk by two men without extra expensive equipment. Three streams of water play around the point of this head when driving, making penetration more rapid. The swing joint is made up of standard fittings and a bronze valve permits cutting out an individual wellpoint for washing off material that has collected after continuous pumping, without interfering with the remaining parts of the system. The header pipe is plain end, 6-inch inside diameter pipe furnished in desired lengths with short threaded inlets welded to the pipe.

The Griffin wellpoint system makes use of the Worthington wellpoint pump designed and built especially for the Griffin system and which offers large air and water capacities and economy in gasoline consumption.

Lima Locomotive Works Absorbs Ohio Power Shovel

The Ohio Power Shovel Co., wholly-owned subsidiary of the Lima Locomotive Works, Inc., Lima, Ohio, has been consolidated with the parent company. All future business involving Lima shovels, draglines and cranes will be handled directly by the Lima Locomotive Works, Inc., Shovel and Crane Division.



The Special Finisher Used in Finishing the Invert in the Val Verde Tunnel

Finishing Machine Used in Tunnel Invert

A novel but thoroughly practical use for a concrete finishing machine is shown in the accompanying illustration. A Blaw-Knox electric road finisher equipped with special concave screeds and solid rubber-tired wheels was used for finishing the invert in the Val Verde Tunnel now under construction for the City of Los Angeles Metropolitan Water Board by the Dravo Contracting Co. of Pittsburgh, Pa. The specifications required that the invert of the tunnel be concreted last after the side walls and arch were poured and the concrete be given a very smooth finish. A special type of Blaw-Knox electric road finisher was designed for this work. The traction and screeds are operated by electric motors and power is furnished from a trolley in the tunnel.

To adapt the finisher for this work it was necessary to build special concave screeds for the tunnel invert, which were hung from the frame of the finisher so that they could function without the use of forms. The machine was equipped with solid rubber-tired wheels to run on a narrow concrete ledge which is integral with the side walls. The rubber tires were necessary to prevent fracture of the concrete ledge. Precise steering by means of automatic brakes on the traction motors, of which there is one for each end truck, was necessary because of the close operating clearances. The finisher is equipped with the usual automatic power-operated screed lift and lowering device for the screed and spring shock absorbers for the screed operation. The finisher is used for both spreading and surfacing the concrete.

New Pneumatic Conveyor Handles Bulk Cement

On the Lock No. 6 contract of Spencer, White & Prentiss of New York at Trempealeau, Wis., on the Mississippi River, a new and simple device is being used to handle bulk cement from hopper-bottom freight cars to the storage bins above the cement batcher. This Robinson air-activated conveyor has no moving parts and has been used successfully to handle over 80,000 barrels of cement on this job. A 300-cubic foot tank is set beneath the railway tracks into which two of the slide gates at the bottom of the cement car deliver through a canvas spout and metal hopper equipped with an air-operated cut-off gate.

Cement flows into the tank by gravity and when it is nearly full, the cut-off gate is shut and air at 45 pounds pressure is admitted through an inlet manifold which has two banks of air jets reaching nearly to the bottom of the tank, one bank on either side of the pick-up nozzle of the Robinson unloader. This activates or fluffs the cement so that it is readily discharged through a 4 or 5-inch flanged steel tubing conveyor line up to a maximum distance of 1,000 feet when a valve is opened on the line, permitting the pressure of air in the tank to blow the cement through the conveyor line. For shorter distances pressures ranging from 30 pounds down to 15 pounds have been used successfully. The cycle of operation is: loading the tank, aerating the cement, and chuting, which is done in

5-minute cycles. The area of the pick-up nozzle is three times the area of the pipe insuring rapid handling of the cement to the conveyor line. The Robinson air-activated conveyor, a patented device, is made by E. Gwynn Robinson, 10 E. 43rd St., New York City.

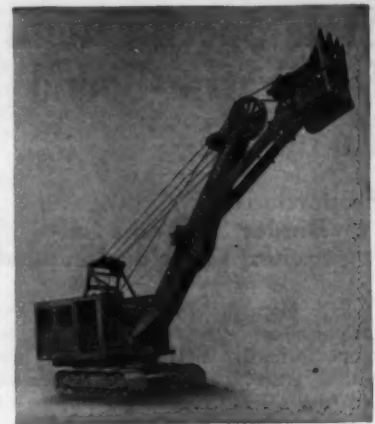
Highway Maintenance Cost Paid by Truck Taxes

In the State of Illinois, the entire cost of highway maintenance is paid by truck taxes. Chester G. Morris, Director of the Illinois Highway Users' Conference, stated in a recent issue of *Manufacturers News*:

"If there were no passenger cars operating on the Illinois highways, the revenue that the State derives from license fees on trucks and from the gasoline tax paid on gasoline consumed by those trucks would be adequate to pay for the entire maintenance cost of our state highway system—and nearly all of the interest on both the \$100,000,000 and the \$60,000,000 bond issues. If trucks were legislated off our highways, it would be necessary to increase the gasoline tax and the license fee paid by passenger cars about 50 per cent, if the State were to collect the same revenue for highway use as they are collecting now."

Two-Cubic Yard Shovel Announced by Koehring

A 2-cubic yard shovel convertible to either crane or dragline and furnished with gasoline, diesel, oil or electric power has been announced by the Koehring Co., Milwaukee, Wis. This machine has independent and positive chain or cable crowd, and is equipped with a sturdy, high-strength welded



The New Koehring 2-Yard Shovel

shovel boom. Among the many other features are the Koehring hydraulically cushioned clutch and the exclusive Koehring boom foot shock absorber.

**Tops them all
in service
but at the bottom
in operating costs:—**

**THE
HYB-LUM
WHEELBARROW**

Interested? Write:
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For Literature and Further Information

THE HELTZEL STEEL FORM & IRON CO.

Warren, Ohio, U.S.A.

State Specifications for Traffic-Bound Roads

Proportions of Aggregate, Binder Soil, and Calcium Chloride Included

THE Michigan State Highway Department is probably the first to adopt formally specifications for stabilized gravel surfaces in accordance with the recently developed science of soil density. Its new manual of Standard Specifications released by Murray D. Van Wagoner, Commissioner of Highways, sets forth the detailed requirements for gravel surface courses to conform with specified limits and minimums of coarse aggregate, fine aggregate, binder soil and calcium chloride treatment.

State engineers expect that the uniform adoption of these specifications will not only produce uniform low-cost, all-weather surfaces for light traffic roads, but will provide adequate base course for subsequent stages of surface construction. The state has already stabilized considerable mileage of trunk highways and many of the counties are following the same procedure in surfacing and reconditioning the traffic-bound rural roads. The specifications, as being the first officially published, covering stabilization are reprinted below:

Stabilized Gravel Surface

This work shall consist of a gravel surface course stabilized with natural soil binder and calcium chloride, when so provided or authorized, constructed on a prepared base course.

Mineral Aggregates

Coarse Aggregate.—The coarse aggregate shall comprise the portion retained on a No. 10 sieve and shall consist of gravel, crushed stone, blast furnace slag, or combinations thereof. In all cases 100 per cent shall pass a screen having $\frac{3}{4}$ -inch round openings.

Fine Aggregate.—The fine aggregate shall comprise the portion passing a No. 10 sieve and retained on a No. 270 sieve, and shall consist of sand, crushed stone, slag or combinations thereof.

Natural Soil Binder (Clay).—The natural soil binder shall consist primarily of fine soil particles and shall contain no stones which will not conform to the coarse aggregate requirements and shall not contain more than 5 per cent organic matter. Its binding properties shall be such that it provides the required physical properties to the finished mixture, as described herein.

Calcium Chloride.—As specified under Miscellaneous Materials.

Composition of Mixture

The finished mixture shall consist of coarse aggregate, fine aggregate and natural soil binder, supplied separately or in combination, to conform to the following composition limits, by weight:

Passing $\frac{3}{4}$ -inch screen	100 per cent
Passing $\frac{1}{2}$ -inch screen	60 to 90 per cent
Passing No. 10 sieve	35 to 50 per cent
Passing No. 40 sieve	20 to 40 per cent
Passing No. 270 sieve	10 to 30 per cent

The fraction passing the No. 270 sieve shall be less than two-thirds of the fraction passing the No. 40 sieve. The fraction passing the No. 40 sieve shall have a plasticity index between 6 and 14 as determined by the physical test methods of the U. S. Bureau of Public Roads. (Described in "Public Roads," Vol. 12, No. 8, October 1931.)

The proportions of coarse aggregate, fine aggregate and natural soil binder, required to give the finished mixture described above, will be determined by laboratory tests on the materials which are to be used.

(A) Construction on Gravel

(a) Widening Existing Surface.—Where shown on the plans or directed by the Engineer the existing surface shall be widened to the required width. This shall be accomplished by excavating to a depth and a width on each side of the existing gravel surface as shown on the plans. These excavations shall then be filled with fine and coarse aggregate in proportions corresponding to those in the finished mixture. The material excavated shall be used in building up the shoulders.

(b) Spreading and Pulverizing of Soil Binder (Clay).—All available loose material on the roadway shall be spread to a width of 8 to 12 feet down the center of the road and the required amount of clay shall be uniformly spread over the surface of this loose material and over the widened portion of the surface, for air drying. The clay shall be pulverized during the drying period until all will pass a 1-inch screen and not less than 95 per cent will pass a $\frac{1}{4}$ -inch screen. The mixture of clay and loose materials shall be uniformly windrowed along the shoulders, except when the clay is being dried in the daytime or when pulverizing operations are being carried on.

(c) Scarifying.—After the clay has been dried, pulverized and incorporated with the loose material from the road, the mixture shall be uniformly distributed over the surface of the road and the latter shall be scarified to a depth of 3 inches, but in no case shall the base be scarified to a point lower than within 4 inches of the bottom of the base.

If the quantity of soil binder and loose material is so great that it interferes with the scarifying operation, the Engineer may direct that the mixture be left in windrows along the shoulders of the road during the scarifying process. When this is done, the scarified road material shall be bladed on top of such windrows and thorough mixing of all materials accomplished as provided in the following paragraph.

(d) Mixing Road Materials.—All the loose and scarified gravel and the added clay binder shall be thoroughly mixed. The materials shall be bladed into windrows at the side of the road, then back to the center, and this operation repeated until a uniform mixture has been obtained. Harrows, multiple-blade maintainers or mixers may be used to supplement the blading.

(e) Removal of Over-size Stones.—During or immediately after the mixing operation all stones which will not pass a 1-inch circular screen shall be removed by mechanical or hand rakes and disposed of as directed by the Engineer.

(f) Sprinkling and Compaction of Road.—When the road material is dry, the addition of water will be required, which shall be supplied in the following manner:

The mixture of binder and gravel shall be bladed onto the shoulders of the road. The base shall be moistened uniformly using a suitable sprinkler. Approximately one-fourth of the material from the windrows shall be bladed immediately onto the moistened base. The newly distributed road material shall be similarly moistened and covered as before with one-fourth of the original windrowed gravel. These operations shall be repeated until the last layer of dry mixture has been placed.

Before moistening this top surface material, the road shall be shaped and compacted, using truck graders, traffic, other trucks, or rollers as directed by the Engineer. During the compaction operation, care must be exercised to maintain a smooth surface and a crown as shown on the plans. After shaping is completed the surface shall be thoroughly dampened and again compacted.

The foregoing operations may be carried on during or immediately follow-

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ing a period of rainfall and the need for water addition thus eliminated. The necessity for such water addition and the amount to be used shall be determined by the Engineer.

Should the dry-mixed materials become wet from rainfall while in windrows, the mixture may be bladed onto the road surface, shaped and compacted while drying takes place. The use of the spring tooth harrow promotes rapid drying. Shaping and compaction shall continue until the moisture has decreased to a point at which the mixture becomes hard. If the surface material is dry after shaping is completed, it shall be dampened and again compacted.

(g) Construction of Surface.—Coarse and fine aggregate in proportions corresponding to those in the finished mixture shall be uniformly spread upon the compacted surface to the proper depth and the process of adding soil binder, scarifying and manipulation shall be repeated as specified above. To secure the proper thickness of the layer the contractor shall use side boards and center board of a height equal to the required depth of the loose layer.

(h) Application of Calcium Chloride.—When so provided or authorized, calcium chloride shall be spread uniformly at the specified rate of 0.6 to 1.5 pounds per square yard of surface.

(B) Construction on a Grade Not Previously Graveled

Construction of Surface.—The construction of the stabilized gravel surface on the prepared subgrade shall be the same as that required on an existing gravel road except as follows:

If the new surface is thicker than 3 inches it shall be built in equal layers not exceeding 3 inches in depth, each layer to be constructed separately as described under section (A) of these specifications.

Calcium chloride, when provided or authorized, is to be added only after the final thickness is obtained.

Method of Measurement

Clay or other binding material used to stabilize the subgrade or existing surface will be measured in original position and the volume computed in cubic yards.

The gravel widening and stabilized gravel surface shall be measured complete in place and will include the square yardage actually accepted within the lines shown on the plans or as authorized.

Calcium chloride will be measured by weight in tons.

Basis of Payment

This work will be paid for as provided below, which shall be payment in full for preparing and stabilizing the subgrade or existing surface, furnishing all materials (unless otherwise provided), spreading and pulverizing the soil binder, scarifying, mixing, sprinkling, compacting and completing the work in accordance with these specifications.

The quantity of clay or other binder material used to stabilize the subgrade or existing surface will be paid for at the contract unit price per cubic yard. "Gravel Widening" will be paid for at the contract unit price per square yard, which price shall be payment in full for widening the existing surface.

"Calcium Chloride—Applied" will be paid for at the contract unit price per ton, which price shall be payment in full for furnishing and applying the calcium chloride.

"Stabilized Gravel Surface" will be paid for at the contract unit price per square yard, which price shall be payment in full for completing the work.

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Larger Headquarters for Distributor

Because of increased business, the Wilson Machinery & Supply Co., of Lexington, Ky., has recently remodeled completely its headquarters at 139-141 North Mill Street. This has made it possible for the company to increase its show room facilities, centralize its parts department and group the offices on the second floor.

New Distributors for Limas

Smith Booth Usher Co., 2001 Santa Fe Ave., Los Angeles, Calif., has been appointed exclusive distributor in Southern California for Lima shovels, cranes, and draglines by Lima Locomotive Works, Inc., Shovel and Crane Division, of Lima, Ohio. H. E. Lowe, Factory Representative, will make his headquarters with the new distributor.

C. D. Murray Likes Tractor Sold by Syracuse Supply

We have received word from the Syracuse Supply Co., 314-318 West Fayette St., Syracuse, N.Y., distributor of Caterpillar tractors and allied equipment, that C. D. Murray of Syracuse, N.Y., a prominent New York State highway contractor, has reported to them astounding low operating and fuel costs on the new Caterpillar Thirty-Five diesel tractor, equipped with a LaPlant-Choate hydraulic bulldozer, recently sold to him.

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Hesseltine & Co.—Concrete Finishing Machinery
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Mortenson Corp.—Wellpoint Systems, Pumps
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Butler Bin Co.—Steel Bins, Weighing Hoppers
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Baker Manufacturing Co.
Williamette-Ersted Co.
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All Steel Products Mfg. Co.

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On Route 40
Phone 813

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Osgood Co.
General Excavator Co.
Hesseltine Corp.
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Timken Roller Bearing Co.
D. A. Lubriant Co.
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Trasken Co.
Applie Culbert Works
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HOISTS — SCRAPERS — WIRE ROPE
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MICHIGAN 3-yd. Truck and Crawler Shovels and Cranes
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CARTER "Humdinger" Pumps

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FLYNN Grader
SAUERMAN Cableways
CLEVELAND Wheelbarrows
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PULSOMETER Steam Pumps
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HYSTER Hoists
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BARNES MFG. CO.—Pumps
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DROTT Bulldozers, Scrapers, Eliminators
HOUGH-UNIVERSAL Sweepers
WAUBSAU Snow Plows
DAVEY Air Compressors
OSHKOSH 4-Wheel Dr. Trucks
KINNEY Road Oilers
TORO Highway Mowers
HERCULES Road Rollers
LA CROSSE Tu-Way Trailers
CLEVELAND Rock Drills
HAUCK Tar Kettles, Hoists
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BLACKMER Pumps
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FOOTE Pavers
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Hoisting Engines
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MARION STEAM SHOVEL CO.

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National Equipment Corp.
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Sterling Machinery Corp.
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The Buda Company
Hi-Way Trailer Co.
Pioneer Gravel Eq. Mfg. Co.
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EUCALID Equipment
P. & H. Shovels and Cranes
PEDLAR PEOPLE'S Culverts



FIGHTING EROSION WITH 90 MILES OF TERRACE IN THE WASATCH MOUNTAINS, UTAH SEE PAGE 27



LOOKS LIKE A TUNNEL—BUT IT ISN'T. IT IS PART OF THE SETTING FOR THE MOVIE "UNDER PRESSURE" SEE "PICKS AND SHOVELS" PAGE 1



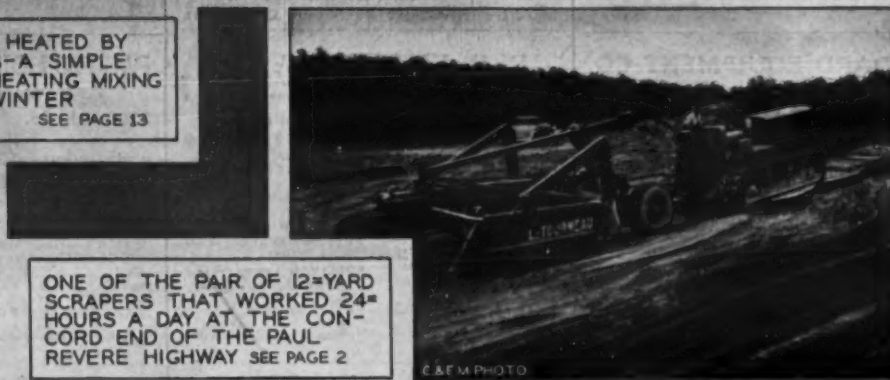
RIBBED ROLLS HELPED COMPACT THE EMBANKMENT OF THE HARTFORD, CONN., DAM AT BARKHAMSTED SEE PAGE 17



STEEL FORMS WERE USED FOR UPPER LIFTS OF THE CORE WALL OF THE BARKHAMSTED DAM SEE PAGE 1



WATER COILS, HEATED BY CYLINDER GAS—A SIMPLE METHOD OF HEATING MIXING WATER FOR WINTER CONCRETING SEE PAGE 13



ONE OF THE PAIR OF 12-YARD SCRAPERS THAT WORKED 24 HOURS A DAY AT THE CONCORD END OF THE PAUL REVERE HIGHWAY SEE PAGE 2



COMPLETING LOCK AND DAM NO. 3 ON THE KANAWHA RIVER AT MARMET, W. VA. SEE PAGE 26



A STEEP HILLSIDE SECTION OF THE 1,630-FOOT OWYHEE SIPHON, OREGON SEE PAGE 24